[f. 382.]

ANATOMICO-CHIRURGICAL

VIEWS

OF THE

NOSE, MOUTH, LARYNX, & FAUCES;

WITH

APPROPRIATE EXPLANATIONS AND REFERENCES.

BY JOHN JAMES WATT,

SURGEON.

THE ENGRAVINGS EXECUTED BY HOPWOOD,

FROM ORIGINAL DRAWINGS BY BAXTER:

TOGETHER WITH

AN ADDITIONAL ANATOMICAL DESCRIPTION OF THE PARTS,

BY MR. W. LAWRENCE,

Demonstrator of Anatomy at St. Bartholomew's Hospital.

LONDON:

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AND SOLD BY

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Οὕτω γὰρ ἂν μάλιστα ἧ δυνήσομαι εἰπεῖν, ἧ ὑμεῖς μαθήσεσθε.

ÆSCHINES, ΠΕΡΙ ΠΑΡΑΠΡΕΣΒΕΙΑΣ.—ORATOR. GRÆC.
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TO

JOHN ABERNETHY, ESQ. F.R.S.

TEACHER OF

ANATOMY, PHYSIOLOGY, & SURGERY,

Assistant Surgeon to St. Bartholomew's Hospital, Honorary Member of the Royal Medical Society of Edinburgh, &c. &c.

DEAR SIR,

I CONGRATULATE myself upon the opportunity of presenting you with the following Pages, as a testimony of the grateful sense I feel for the repeated marks of kindness and attention you were in the habit of conferring upon me, during my professional studies at St. Bartholomew's Hospital.

It is far from my intention to crowd the present Dedication with fulsome panegyric upon your virtues, which are indeed too numerous and apparent not to claim regard, and which have raised you so far beyond the reach of human invective, as to leave you "little to fear or hope from censure or from praise."

With every respect for your high talents as a Surgeon, and your excellent character as a Man, I have the satisfaction to subscribe myself,

Your most respectful

Humble Servant,

JOHN JAMES WATT.

94, *Bartholomew Close,*
1st January, 1809.

TO

JOHN ABERNETHY, ESQ. F.R.S.

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ANATOMICO-CHIRURGICAL VIEWS,

&c.

EXPLANATION OF PLATE I.

IT is the principal object of this Plate to exhibit, at one view, the bag of the pharynx, together with the openings of various organs connected with that cavity; and, at the same time, to shew the manner in which its internal membrane is continued with the linings of those parts.

I shall, in the first place, explain the various steps employed in order to obtain a free exposure of these parts by dissection, and afterwards proceed to a general view of the subject.

After having separated the head, with the seven cervical vertebræ, from the rest of the body, these vertebræ, together with the muscles of the neck, were removed, so as to leave the pharynx entire, together with the larynx, part of the œsophagus and trachea, the large blood vessels, nerves, and the parts concerned in the cavity of the mouth. In this manner the whole back of the pharynx was fully exposed. That part was then opened along the middle of its posterior surface by a straight incision, commencing at the basilar process of the occipital bone, and continued as far as the œsophagus. It was also necessary to separate the posterior circumference of the bag from its attachment to the basis cranii, in order to allow the divided edges to be more fully drawn aside, and thereby to gain a more free exposure of these organs. A portion of the pharynx was afterwards cut away on the right side, to bring the nerves and blood-vessels more clearly into view. By these means a complete view of the cavity of the pharynx was obtained, from behind; such, in short, as is represented in Plate I; in which the openings of the nose, the terminations of the Eustachian tubes, the velum palati with the uvula, the tonsils, the communication between the mouth and pharynx, the root of the tongue, the glottis, epiglottis, and the passage of the pharynx into the œsophagus are distinctly seen.

The internal mucous membrane of the pharynx is not only connected with each of the organs of sensation, but those of respiration and digestion are also most intimately united with it. As this membrane has a direct continuation into the œsophagus, its course through the whole intestinal canal may be traced

even to the orifice of the anus, where it is gradually lost among the common integuments. It afterwards passes from the duodenum through the ductus communis choledochus to the gall-bladder and pori biliarii, and along the pancreatic duct to the substance of the pancreas. The same membrane not only covers the posterior surface of the larynx, but, after including the epiglottis, enters the cavity of that organ through the rima glottidis, passing along the trachea and its ramifications, even to their termination in the substance of the lungs.

There is a difference in appearance between the membrane of the mouth and the mucous lining of the pharynx; but the structure of both parts is the same. It proceeds from the velum palati and root of the tongue into the cavity of the mouth: having invested the tongue and afforded a covering to the internal surface of the cheeks and salivary glands, whose ducts it permeates, it is again lost in the external integuments at the lips. This membrane also enters the cavity of the nostrils, where it forms the pituitary membrane; and, proceeding along the apertures of the Eustachian tubes, lines the internal surface of the membrana tympani, as well as the cavity of the tympanum itself. It is then extended over the cavity of the nostrils, covering the septum narium and turbinated bones; and entering the frontal, ethmoidal, sphenoidal, and superior maxillary sinuses, it is again lost in the external skin about the nostrils; but is previously continued into the nasal duct with its sac and lacrymal ducts, and, through the puncta lacrymalia, is once more united with the common integuments. Here the tunica conjunctiva commences, and not only covers the anterior surface of the eye-ball, but is continued through the excretory ducts even to the substance of the lacrymal glands; and affords a covering to the Meibomian follicles and caruncula lacrymalis.

If, when we observe the continuations of this membrane, we also consider the distribution of its nerves, its lymphatics, and blood-vessels, we shall have no difficulty in admitting the existence of a principle of sympathy, by which the diseases of one organ are transmitted to another; and in recognizing the advantages which may be derived from this source in the employment of remedies.

The muscular structure of the pharynx, the contiguity of the carotid arteries, jugular veins, sympathetic nerves, as well as of the paria vaga, accessory, lingual, hypoglossal and glossopharyngeal nerves, are so many additional motives for considering the share which this organ bears in the process of gargling, in coughing, spitting, deglutition, sneezing, laughing, weeping, inflation of the cheeks, singing, and other actions; especially if we advert to the motions performed by the pharynx under these circumstances, and the various degrees of contraction and dilatation which it experiences.

Since, however, it would be departing too far from my original intention, to treat so copiously on these subjects as their importance and extent might demand, I recommend them to the attentive consideration of the reader; and proceed to point out the parts individually as they occur in the outline figure.

References to Plate I.

A. A. Parietal bones.

B. Occipital bone.

C. C. Temporal bones.

D. D. Inferior maxillary bone.

E. Internal sloping surface of the basilar process of the occiput, viewed partially through the foramen occipitale magnum.

a. a. Eminences of bone to which certain muscles of the neck are attached.

b. b. Mastoid holes, irregular in size, situation, and number, for the transmission of veins to the lateral sinuses.

c. c. Mastoid processes.

d. d. Condyles of the occiput.

e. Foramen occipitale magnum.

f. Posterior margin of the foramen jugulare of the left side, the parts which pass through it having been removed.

g. Posterior margin of the foramen jugulare of the right side, with the jugular vein and par vagum in their passage through that aperture.

h. Foramen carotideum of the left side.

i. Posterior margin of the right foramen carotideum, with the carotid artery, and the branch which is continued from the sixth pair to the superior cervical ganglion of the great sympathetic nerve, passing through it.

j. Depression within the mastoid process, for the attachment of the posterior portion of the digastric muscle of the left side; that portion of the muscle having been reflected.

k. k. Rami of the inferior maxillary bone.

l. l. Angles of the inferior maxillary bone.

m. Masseter muscle of the left side.

n. Internal pterygoid muscle of the left side.

o. External pterygoid muscle of the left side.

p. Ligament connecting the corniculum of the os hyoides to the styloid process of the left side.

q. Styloglossus muscle of the left side.

r. Stylopharyngeus muscle of the left side.

s. Stylohyoideus muscle of the left side.

t. Inferior maxillary nerve of the left side.

u. Lingual branch of the inferior maxillary nerve of the left side.

v. Posterior portion of the digastric muscle of the right side.

w. Styloid process of the right side, with the muscles to which it gives origin arising from it: these are represented too near their origin, and too much in shade to admit of being marked by distinct letters of reference.---See the opposite side.

x. x. Internal jugular vein of the right side.

y. y. Par vagum of the right side.

z. z. Carotid artery of the right side.

1. 1. Great sympathetic nerve, with part of its superior cervical ganglion exposed; the rest being concealed by the right internal jugular vein.

2. Posterior margin of the vomer, forming the back edge of the septum narium.

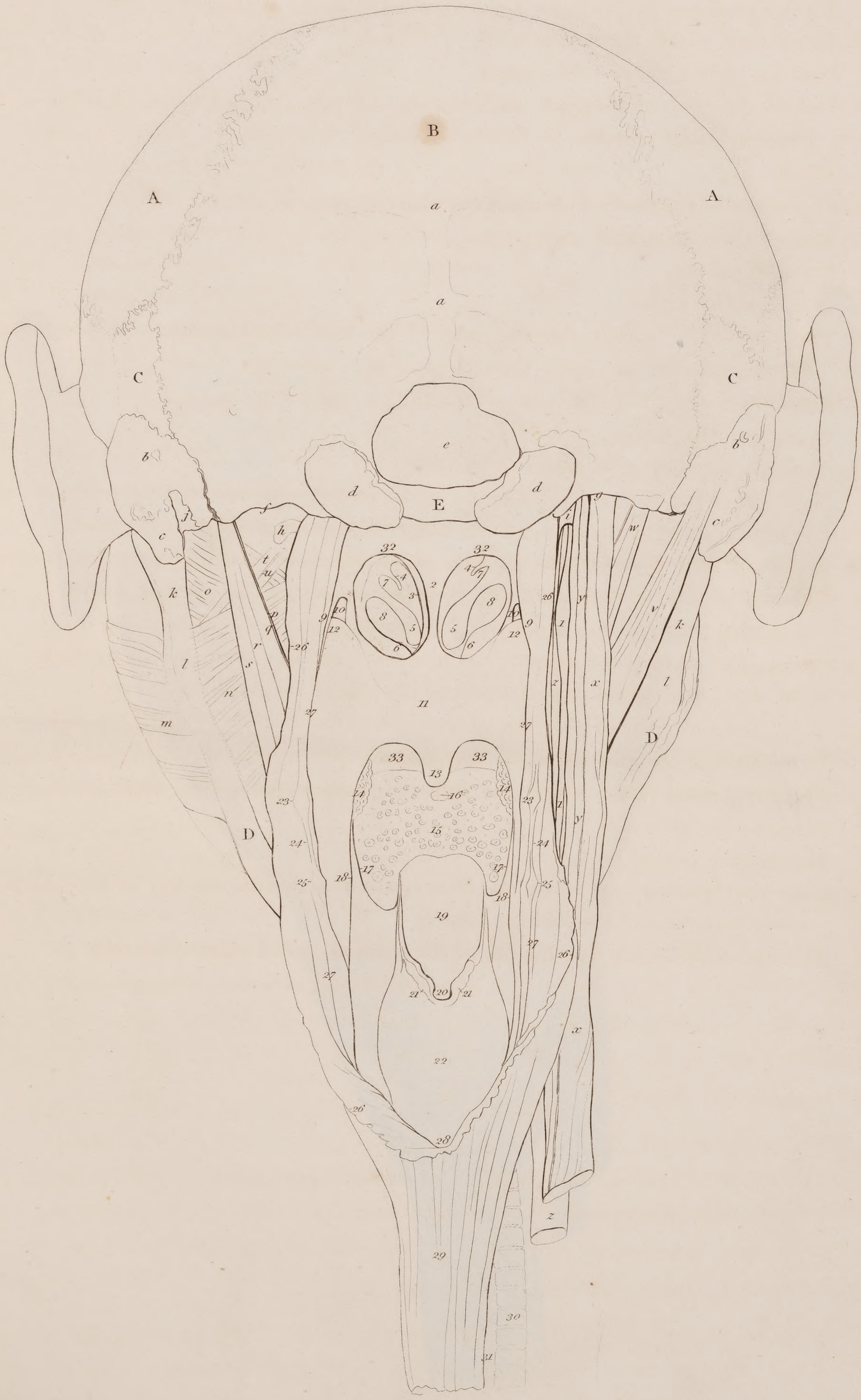
3. Inclination of the vomer towards the left side of the cavity of the nostrils. The septum of the nose is seldom straight; and its most frequent deviation is towards the left side.

4. 4. Posterior extremities of the superior turbinated bones.

5. 5. - - - - - - - - - - middle turbinated bones.

6. 6. - - - - - - - - - - inferior turbinated bones.

7. 7. Superior meatus narium.
8. 8. Middle meatus narium. The inferior cannot be seen in this view of the parts.
9. 9. Eminences caused by cartilages at the extremities of the Eustachian tubes.
10. 10. Termination of the Eustachian tubes.
11. Posterior surface of the velum palati.
12. 12. Lateral elevations of the upper surface of the soft palate caused by the situation of the levatores palati muscles.
13. Uvula.
14. 14. Projections of the tonsils in front of the pharyngopalatine arches.
15. Root of the tongue, with its papillæ.
16. Foramen cæcum.
17. 17. Glossopalatine arches.
18. 18. Pharyngopalatine arches, covering part of the tonsils, and forming the sides of the isthmus faucium, as viewed from the pharynx.
19. Epiglottis.
20. Opening of the glottis.
21. 21. Cornicula laryngis.
22. Back part of the larynx, formed by the broad posterior portion of the cricoid cartilage.
23. 23. Eminences caused by the posterior extremities of the cornua of the os hyoides.
24. 24. Prominent lines denoting the situation of the ligaments which connect the posterior cornua of the os hyoides to the superior cornua of the thyroid cartilage; and appearing through the membrane of the pharynx.
25. 25. Prominences shewing the situation of the superior cornua of the thyroid cartilage.
26. 26. 26. 26. Cut edges of the posterior part of the bag of the pharynx.
27. 27. 27. 27. Internal membrane of the pharynx.
28. Termination of the pharynx in the œsophagus.
29. Posterior portion of the œsophagus, with its longitudinal muscular fibres.
30. Trachea.
31. Membranous part of the trachea.
32. Large oval openings, by which the nose communicates with the bag of the pharynx, called posterior nares, or choanæ narium.
33. Opening of the mouth into the bag of the pharynx, called isthmus faucium.



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EXPLANATION OF PLATE II.

THE views exhibited in the two first Figures of this Plate, are such as would be obtained by a section made in a dextro-sinistral direction from immediately behind the crista galli, to the interspace between the sixth and seventh grinding tooth of the upper jaw on either side; the lower jaw, with its teeth, remaining entire.

In the *first* figure, the cut surfaces of the bones, forming the front section, together with a transverse division of the orbits of the eyes, ethmoidal cells, turbinated bones, general cavity of the nostrils, antra or superior maxillary sinuses, bony palate, and palatine membrane, are accurately represented. The small valvular productions, behind which the openings from the antra terminate, are likewise represented in an undivided state.

As the preceding figure exhibits a front section of these parts as they appear when viewed from behind, the *second* figure will give the reader a correct idea of the posterior section viewed according to its front aspect. He will also be enabled to form a clear notion with respect to the original magnitude and extent of each of the above-mentioned parts as they occur in both of these sections. The velum palati, with the uvula, the membranous folds in which the tonsils are contained, the tonsils themselves, together with the anterior portion of the dorsum of the tongue, with its papillæ, may now be distinctly seen in front, and exhibit an opposite view to that delineated in Plate I, in which the posterior surfaces of these parts are alone visible.

The lower part of the cheeks and under lip everted, a small portion of the buccinator muscle, where it is attached to the superior and inferior maxillary bones on the right side, a portion of the external pterygoid muscle in its passage to the condyle of the lower jaw, the inferior maxillary branch of the fifth pair of nerves in its descent to the inferior maxilla on the opposite side, part of the trachea and œsophagus, together with the lower jaw and teeth, are the only additional parts requiring attention in this view of the subject.

The periosteum of the left orbit was removed for the purpose of rendering the foramina more distinct. The periosteum of the right orbit has been preserved, and will serve to explain the manner in which the infra-orbitar foramen is completed above by a continuation of this membrane over it.

The various openings into the cavity of the nostrils, at a single view, form the subject of the *third* figure of this Plate. And here the student may obtain a competent knowledge of the direction and course of these channels, and of their relative situations to each other. A knowledge of this kind will also be found of the greatest importance to the practitioner, as the passage of instruments is not unfrequently requisite for the removal of obstructions in some of these openings, or in the course of their canals. They are eight in number, and consist of the openings of the *frontal*, *ethmoidal*, *sphenoidal*, *and superior*

maxillary sinuses, the *Eustachian trumpet*, and *nasal duct*, the anterior aperture of the *nostril* in front, and its termination in the *pharynx* behind.

In order to obtain this view, a perpendicular division was made on the right side of the septum narium, so as to bring the turbinated bones of this side completely into view. A portion of these bones was next removed to the extent delineated in the figure. The probe passed into the nasal duct, shows the direction which that canal takes in its passage from the orbit into the nose: a probe has likewise been passed into the cavity of the sphenoidal sinus through the opening by which it also communicates with the nose.

References to Plate II.

Fig. 1.

A. Internal surface of the frontal bone covered by dura mater.

a. a. Divided edges of the frontal bone.

b. b. Irregular surfaces of the orbitar processes of the frontal bone, upon which the anterior lobes of the brain are situated.

c. c. Divided edges of the orbitar processes of the frontal bone.

d. Crista galli.

e. Frontal spine.

f. f. Superciliary ridges of the frontal bone, viewed through the orbits.

g. g. Divided edge of the cribriform plate of the ethmoid bone.

h. h. h. Ethmoidal cells, divided on the right side of the septum narium.

i. i. i. Ethmoidal cells, divided on the left side of the septum narium.

j. j. Divided edges of the ossa plana of the ethmoid bone.

k. k. Divided edges of the cheek bone.

l. l. Divided edges of the orbitar processes of the superior maxillary bone.

m. m. Infra orbitar grooves.

n. Divided edge of the perpendicular bony plate forming the septum narium, covered by the pituitary membrane.

o. o. Cut edges of the superior turbinated bones, covered by the pituitary membrane.

p. p. Anterior portions of the superior meatus narium.

q. q. Cut edges of the middle turbinated bones, covered by the pituitary membrane.

r. r. Anterior portions of the middle meatus narium.

s. s. Valvular productions behind which the openings from the antra terminate.

t. t. Openings from the antra into the cavity of the nostrils.

v. v. Cut edges of the inferior turbinated bones, covered by the pituitary membrane.

u. u. Anterior portions of the inferior meatus narium.

w. w. w. w. Divided edges of the lateral boundaries of the antra.

x. x. Anterior portions of the antra or superior maxillary sinuses.

y. y. Parts where the cavities of the antra open into the nose.

z. z. Cut edge of the bony palate.

1. 1. Cut edge of the alveolar process of the superior maxillary bone.

2. 2. Cut edge of the palatine membrane.

3. 3. Parts of the cavities for the reception of the fangs of the seventh grinding tooth of the upper jaw, on each side.

4. Anterior portion of the palate.

FIG. 2.

A. Internal surface of the occipital bone, covered by dura mater.
B. B. Alæ of the sphenoidal bone.
C. C. Temporal bones.
D. D. Cheek bones.
E. E. Inferior maxillary bone.
a. a. Divided edges of the frontal bone.
b. b. Irregular surfaces of the orbitar processes of the frontal bone, upon which the anterior lobes of the brain are situated.
c. c. Divided edges of the orbitar processes of the frontal bone.
d. d. Posterior clinoid process.
e. e. Divided edge of the cribriform plate of the ethmoid bone.
f. f. f. Ethmoidal cells, divided on the right side of the septum narium.
g. g. g. Ethmoidal cells, divided on the left side of the septum narium.
h. h. Divided edges of the ossa plana of the ethmoid bone.
i. i. Optic holes.
j. Foramen lacerum of the right side.
k. Foramen lacerum of the left side, the parts which pass through it having been removed.
l. l. Anterior portions of the spheno-maxillary fissures.
m. Infra-orbitar groove of the right side, converted into a foramen by the periosteum of the orbit which passes over it.
n. Infra-orbitar groove of the left side.
o. o. Divided edges of the orbitar processes of the superior maxillary bone.
p. Back portion of the right orbit, covered by its periosteum.
q. Back portion of the left orbit, from which the periosteum has been removed.
r. r. Divided edges of the cheek bone.
s. s. Anterior portions of the zygomatic processes of the temporal bones.
t. Posterior divided edge of the perpendicular bony plate forming the back part of the septum narium, covered by the pituitary membrane.
v. v. Cut edges of the superior turbinated bones, covered by the pituitary membrane.
u. u. Posterior portions of the superior meatus narium.
w. w. Cut edges of the middle turbinated bones, covered by the pituitary membrane.
x. x. Posterior portions of the middle meatus narium.
y. y. Cut edges of the inferior turbinated bones, covered by the pituitary membrane.
z. z. Posterior portions of the inferior meatus narium.
1. 1. 1. 1. Divided edges of the lateral boundaries of the antra.
2. 2. Posterior portions of the antra, or superior maxillary sinuses.
3. 3. Cut edge of the bony palate.
4. 4. Cut edge of the palatine membrane.
5. 5. Fangs of the seventh grinding tooth, on each side.
6. 6. Cut edge of the alveolar process of the superior maxillary bone.
7. 7. Alveolar process covered by the gums.
8. External pterygoid muscle of the right side.
9. Part of the buccinator muscle of the right side.
10. Inferior maxillary nerve of the left side.
11. 11. Coronoid processes of the inferior maxillary bone.
12. Part of the interarticular cartilage of the lower jaw on the left side, the capsule of the joint having been removed to bring this part into view.
13. 13. Rami of the inferior maxillary bone.
14. 14. Angles of the inferior maxillary bone.
15. Anterior surface of the velum palati.
16. Uvula.

17.17. Tonsils.
18.18. Pharyngo-palatine arches.
19.19. Glosso-palatine arches.
20. Opening from the back part of the mouth into the bag of the pharynx, called isthmus faucium.
21. Tongue with its papillæ.
22.22. Membrane of the mouth forming the internal lining of the cheeks.
23.23. Alveolar process of the inferior maxillary bone covered by the gums.
24. Frenum of the under lip.
25. Internal surface of the under lip.
26. Chin.
27. Trachea.
28. Œsophagus.

Fig. 3.

A. Right portion of the frontal bone, covered by dura mater.
a. Cut edge of the frontal bone.
b. Part of the right frontal sinus.
c. c. Cut edge of the skin of the forehead and nose.
d. Cut edge of the right nasal bone.
e. e. Parts from which the superior and middle turbinated bones have been detached.
f. Divided edge of the cribriform plate of the ethmoid bone.
g. Cut edge of the superior turbinated bone.
h. - - - - - middle turbinated bone.
i. - - - - - inferior turbinated bone.
i. Part from which the inferior turbinated bone has been detached.
k. Sphenoidal sinus.
l. Cut edge of the body of the sphenoid bone.
m. Sella turcica or ephippium.
n. Cut edge of the posterior clinoid process.
o. Posterior portion of the superior meatus narium.
p. - - - - - - - - - middle meatus narium.
q. - - - - - - - - - inferior meatus narium.
r. Cut edge of the alveolar process of the superior maxillary bone.
s. Sacculus cæcus of the pharynx.
t. Membranous partition sometimes dividing the sacculus cæcus of the pharynx at this part.
v. Eminence caused by a piece of cartilage at the extremity of the Eustachian tube.
u. Cut edge of the palate bone.
1. Opening of the frontal sinus
2. - - - - - superior maxillary sinus
3. - - - - an ethmoidal sinus
4. - - - - the sphenoidal sinus
5. - - - - - nasal duct
6. - - - - - Eustachian tube
7. - - - - - nostril

} of the right side.

8. Opening of the right nostril into the pharynx.

Fig. 1.

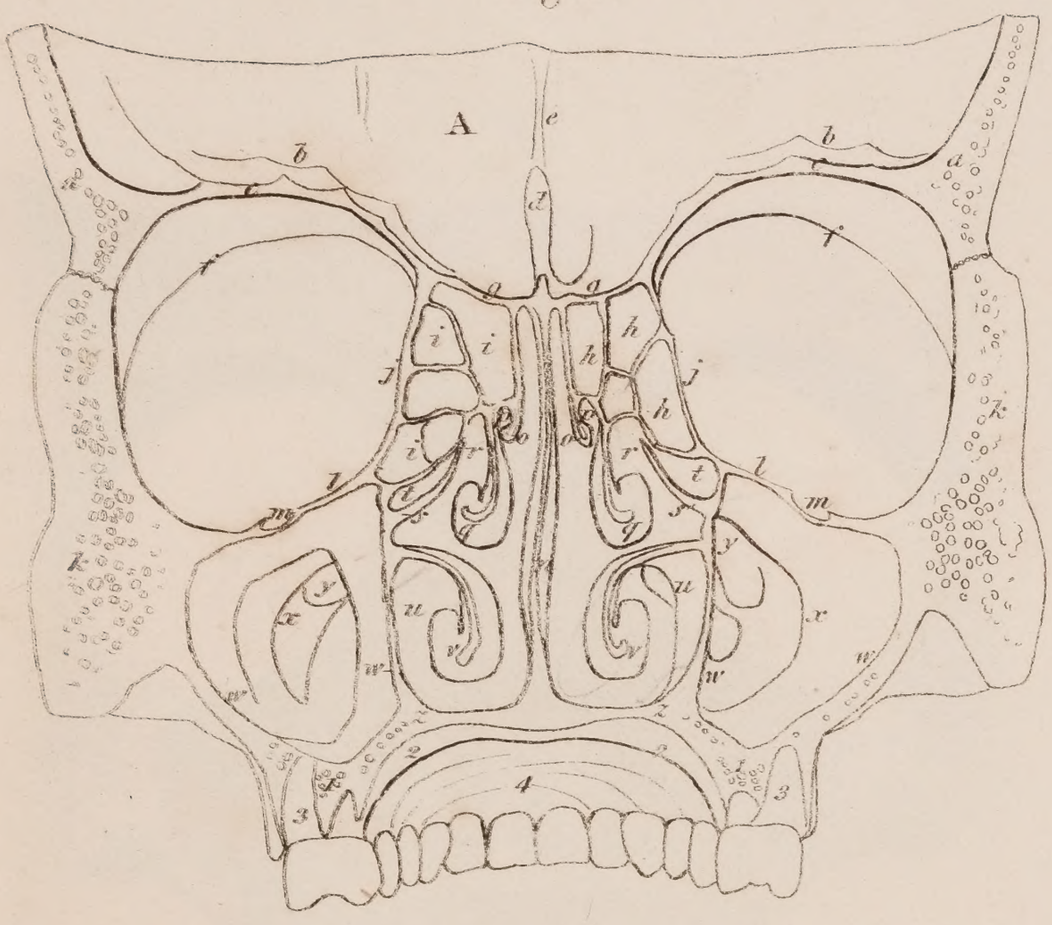
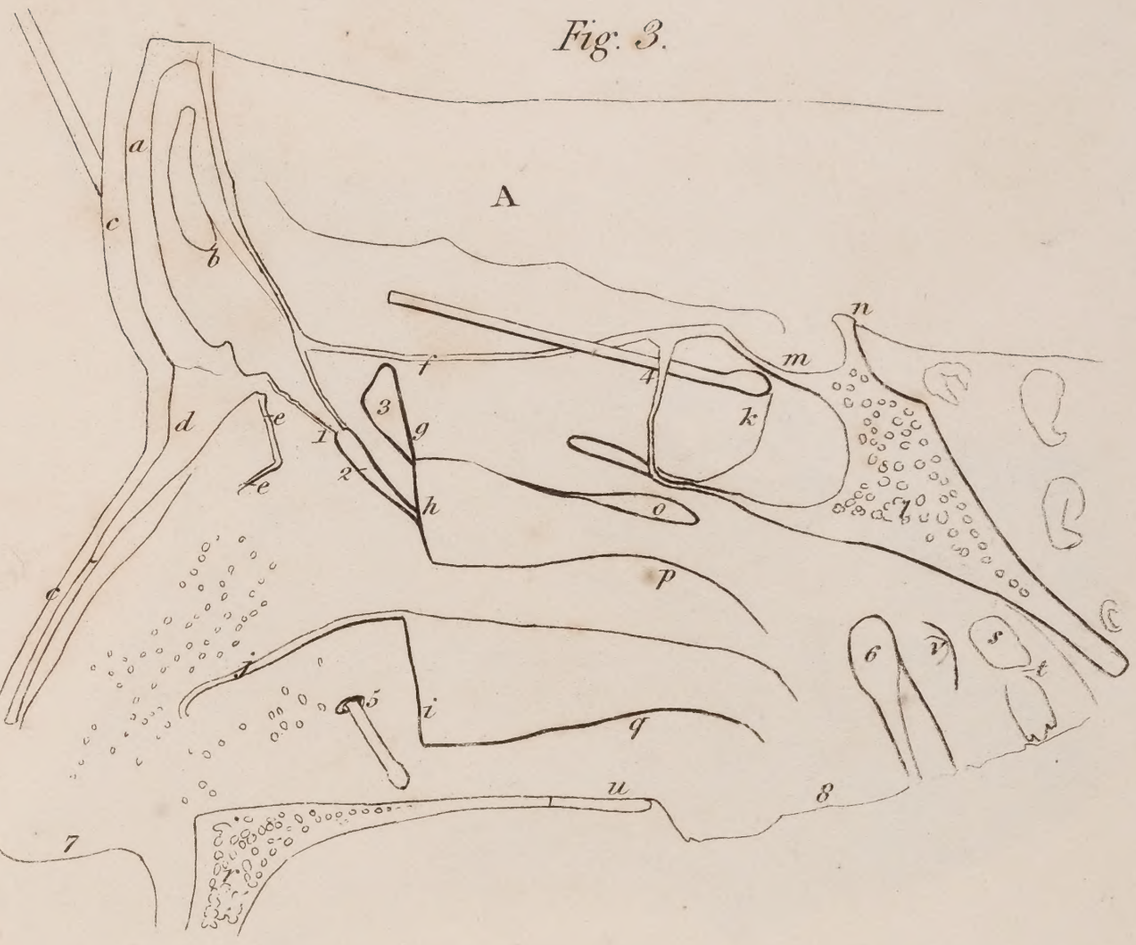


Fig. 3.



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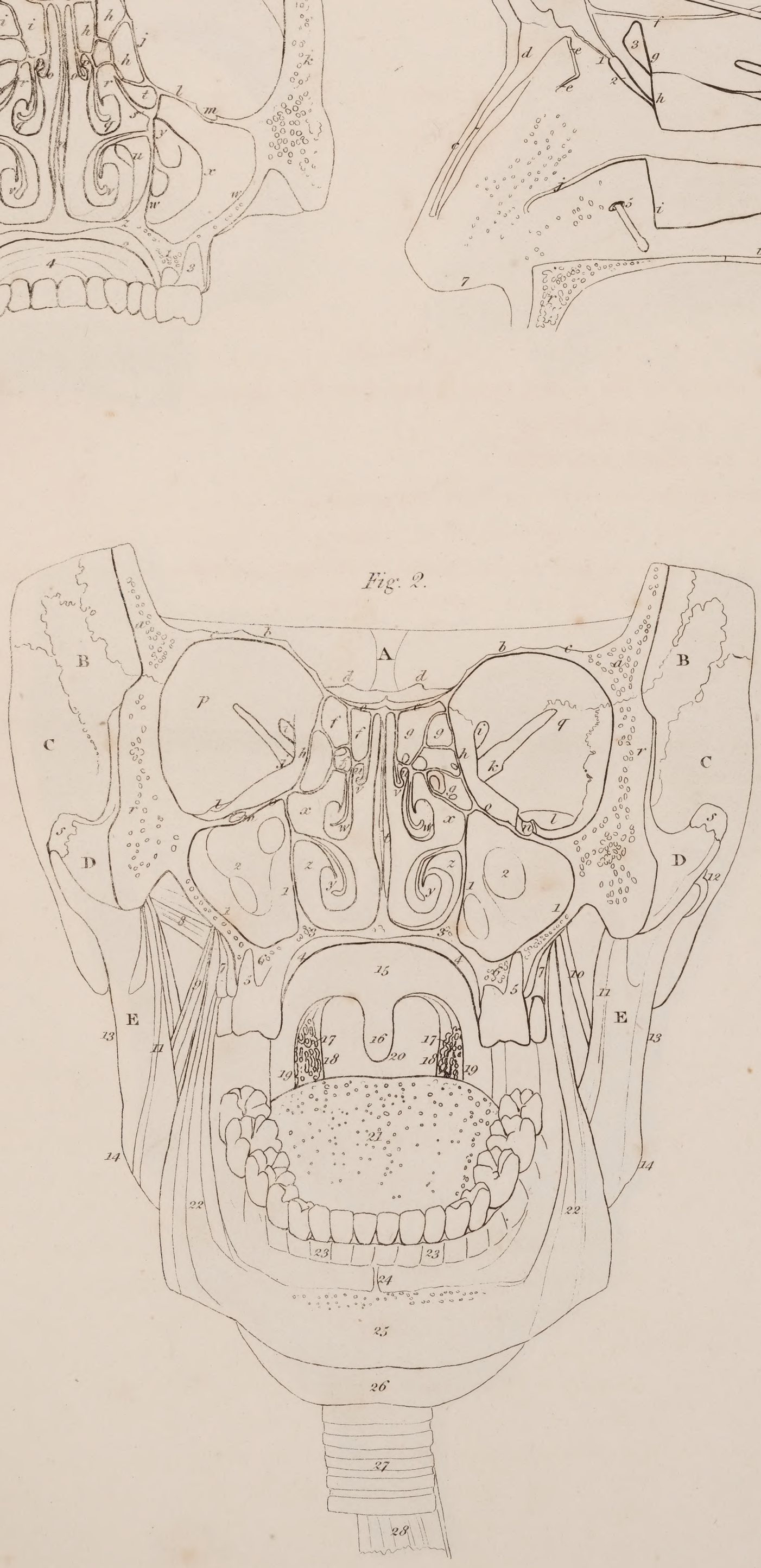

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Fig. 1.

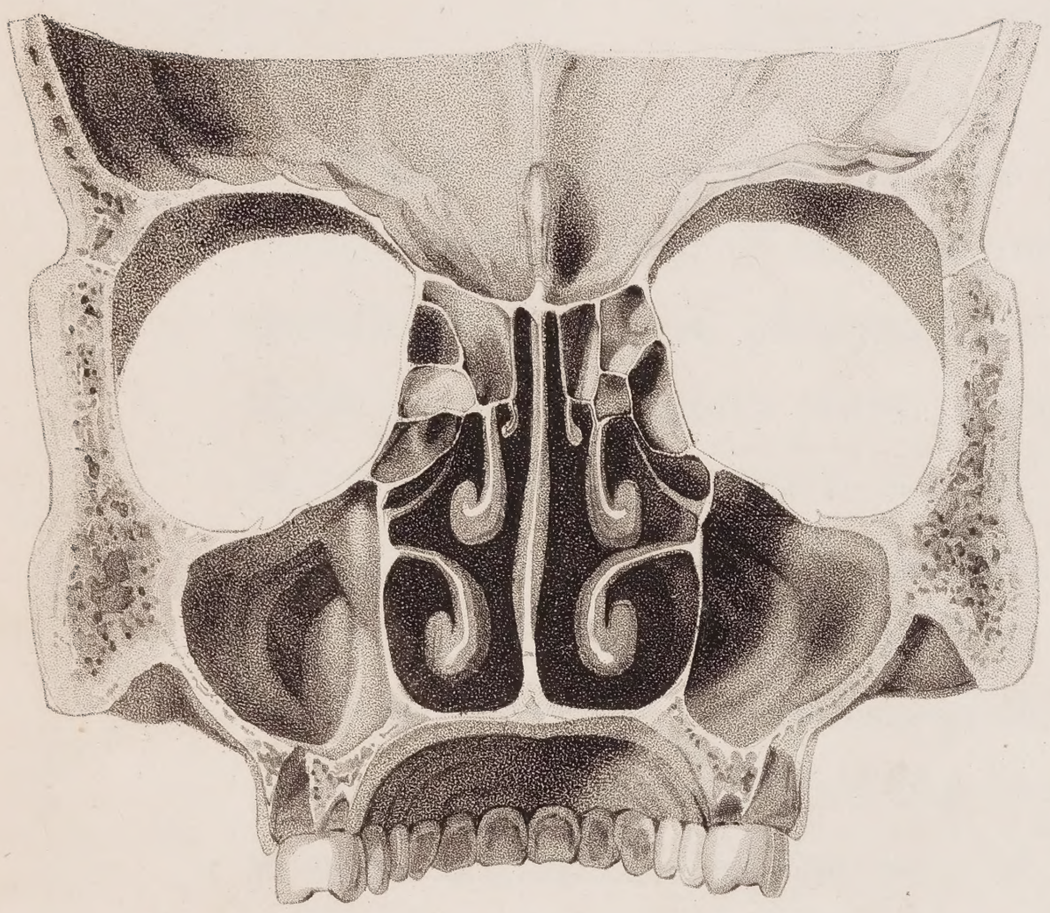


Fig. 3.

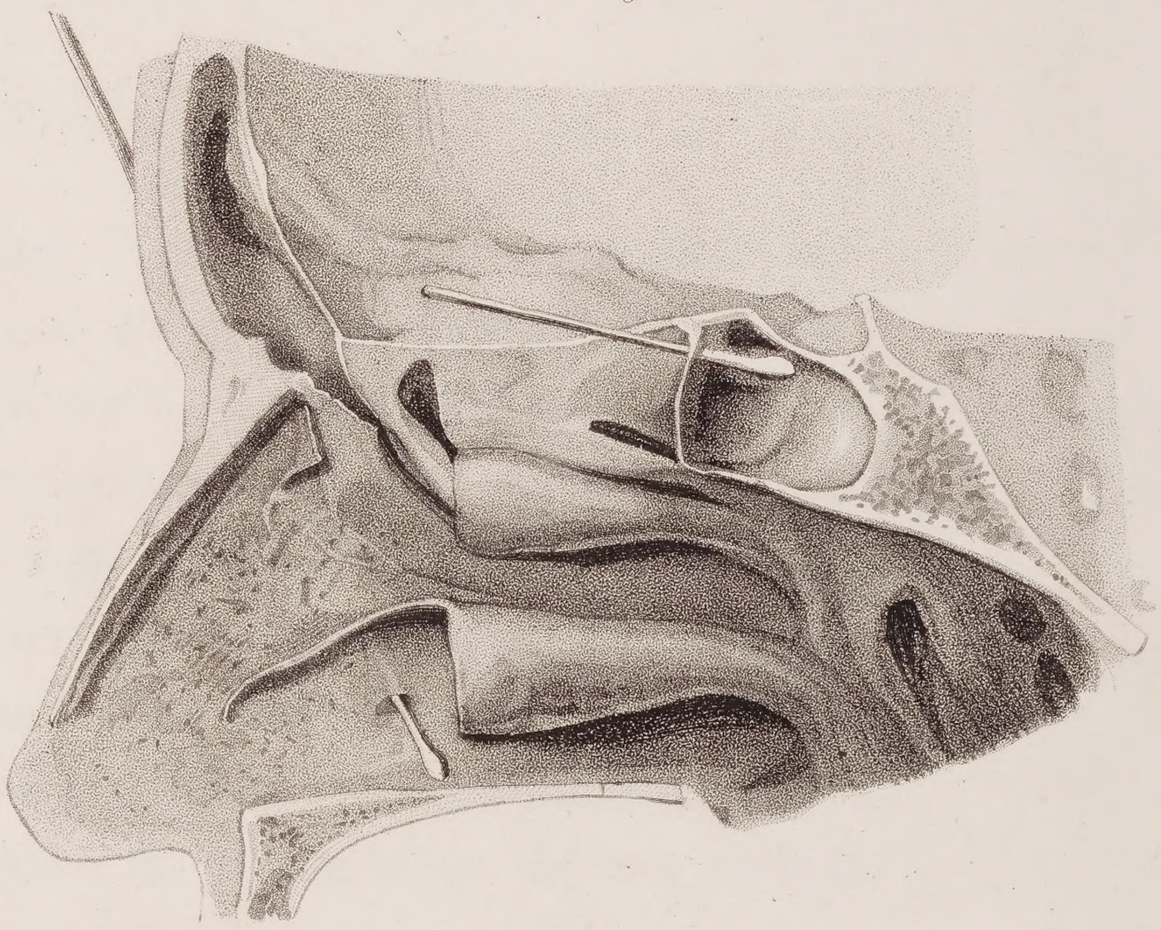
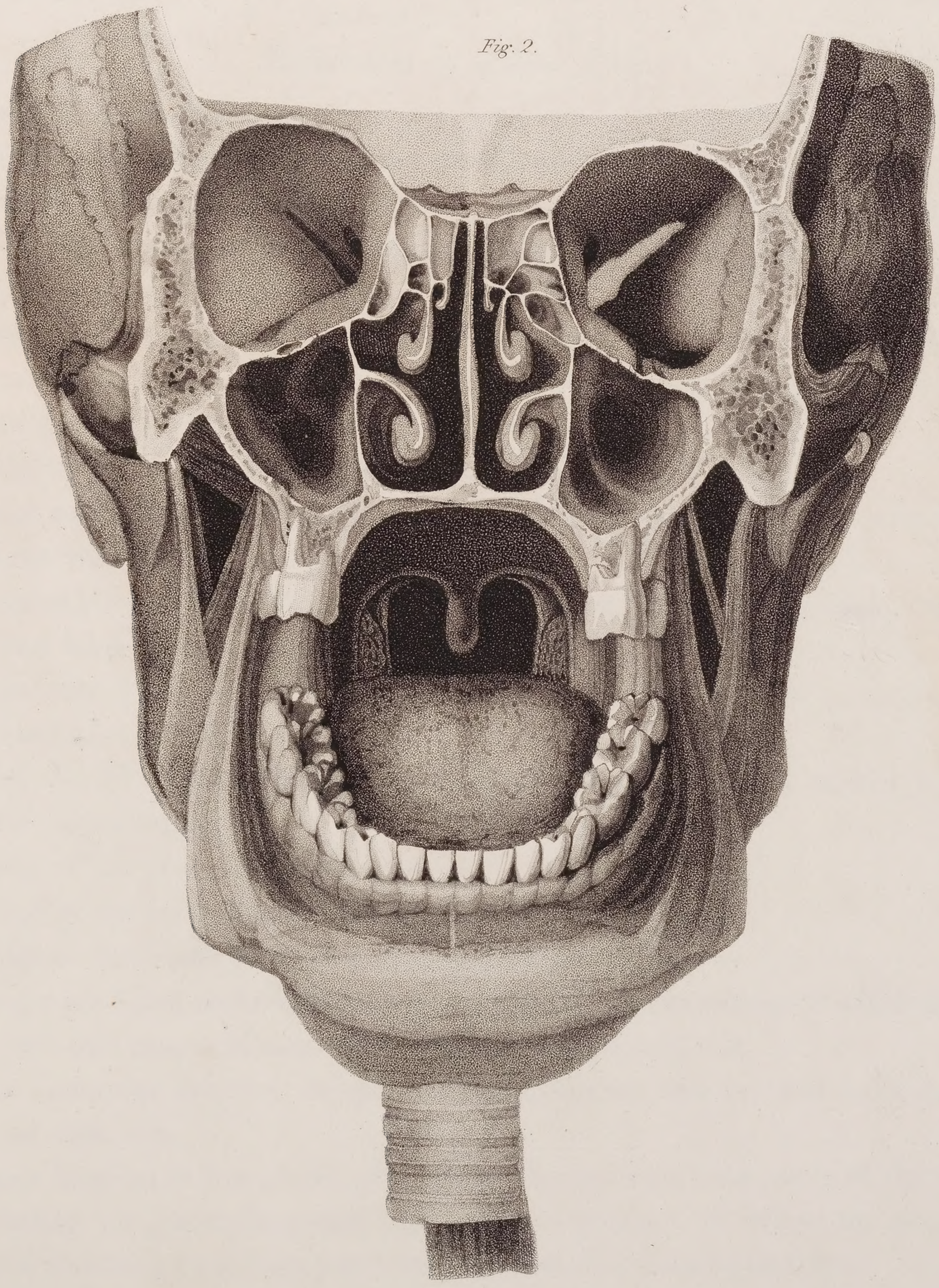


Fig. 2.



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EXPLANATION OF PLATE III.

THE object of this and the succeeding Plate is to give a complete and comprehensive view of the size and relative situation of the cavities of the nose, mouth, larynx, and pharynx, as they appear when viewed laterally, and to shew in what manner those cavities communicate with each other. In order to effect this, the upper part of the cranium, together with the brain, was removed; and afterwards the head, with the seven cervical vertebræ, and the parts situated before and behind the spine, were divided by a perpendicular section carried in the antero-posterior direction, on the left side of the septum narium. The right half of the head, in which the whole of the septum narium is seen, is exhibited in the present plate.

References to Plate III.

a. Cut edge of the frontal bone.

b. Cut edge of the integuments covering the frontal bone.

c. c. Parts of the left frontal sinus which was composed of two cavities in this subject; together with the septa that separate them from those of the opposite side.

d. Cut edge of the nasal bone of the left side.

e. e. Cut edge of the integuments covering the nasal bone and cartilage of the nose.

f.f.f.f. Left surface of the septum narium, covered by the pituitary membrane.

g. Anterior portion of the falx cerebri.

h. Cut edge of the cribriform plate of the ethmoid bone.

i. Irregular surface of the right orbitar process of the frontal bone, upon which the right anterior lobe of the brain is situated.

j. Grooves made by the ramifications of the spinous artery of the dura mater on the parietal bone of the right side.

k. Anterior clinoid process of the right side.

l. Sella turcica, or ephippium.

m. Part of the left sphenoidal sinus, together with the septum that divides it from that of the opposite side.

n. Cut edge of the posterior clinoid process.

o. Cut edge of the body of the sphenoid bone.

p. Cut edge of the basilar portion of the occipital bone.

q. Opening placed just under and behind the edge of the tentorium, at which the nerve of the fifth pair enters its canal of dura mater, on the right side.

r. Meatus auditorius internus, or aperture into which the auditory and facial nerves pass, on the right side.

s. Foramen lacerum in basi cranii, or jugulare, through which the nerve of the eighth pair (including the glossopharyngeal and accessory portions, as well as the proper nervus vagus) and the lateral sinus pass through the skull, on the right side.

t. Foramen condyloideum anterius, which transmits the nerve of the ninth pair, on the right side.

v. Round opening of the dura mater at which the vertebral artery enters the cranium, on the right side.

u. Edge of the tentorium, on the right side.

w. Part above the tentorium, on the right side, in which the right posterior lobe of the brain is situated.

x. Posterior portion of the falx cerebri.

y. Part from which the tentorium has been detached, on the left side.

z. Lateral sinus divided.

1. Cut edge of the occipital bone.
2. Cut edge of the integuments covering the occipital bone.
3. Falx cerebelli.
4. Cavity beneath the tentorium, in which the right lobe of the cerebellum is situated.

5.5.5.5. Cut edges of the membrane lining the spinal canal.

6. Cut edge of the ligament which connects the processus dentatus of the second cervical vertebra to the occiput.
7. Cut edge of the circular ligament which connects the processus dentatus of the second cervical vertebra to the first vertebra or atlas.
8. Cut edge of the front portion of the first vertebra or atlas.
9. Cut edge of the processus dentatus of the second cervical vertebra.
10. Cut edge of the body of the second
11. - - - - - - - - - - third
12. - - - - - - - - - - fourth
13. - - - - - - - - - - fifth
14. - - - - - - - - - - sixth
15. - - - - - - - - - - seventh

} cervical vertebra.

16. Cut edge of the intervertebral substance placed between the bodies of the second and third cervical vertebra.
17. - third and fourth cervical vertebra.
18. - fourth and fifth cervical vertebra.
19. - fifth and sixth cervical vertebra.
20. - sixth and seventh cervical vertebra.
21. Opening at which the suboccipital or first of the cervical nerves penetrates the dura mater on the right side.
22. Opening for the second
23. - - - - - third
24. - - - - - fourth
25. - - - - - fifth
26. - - - - - sixth
27. - - - - - seventh

} cervical nerve of the right side.

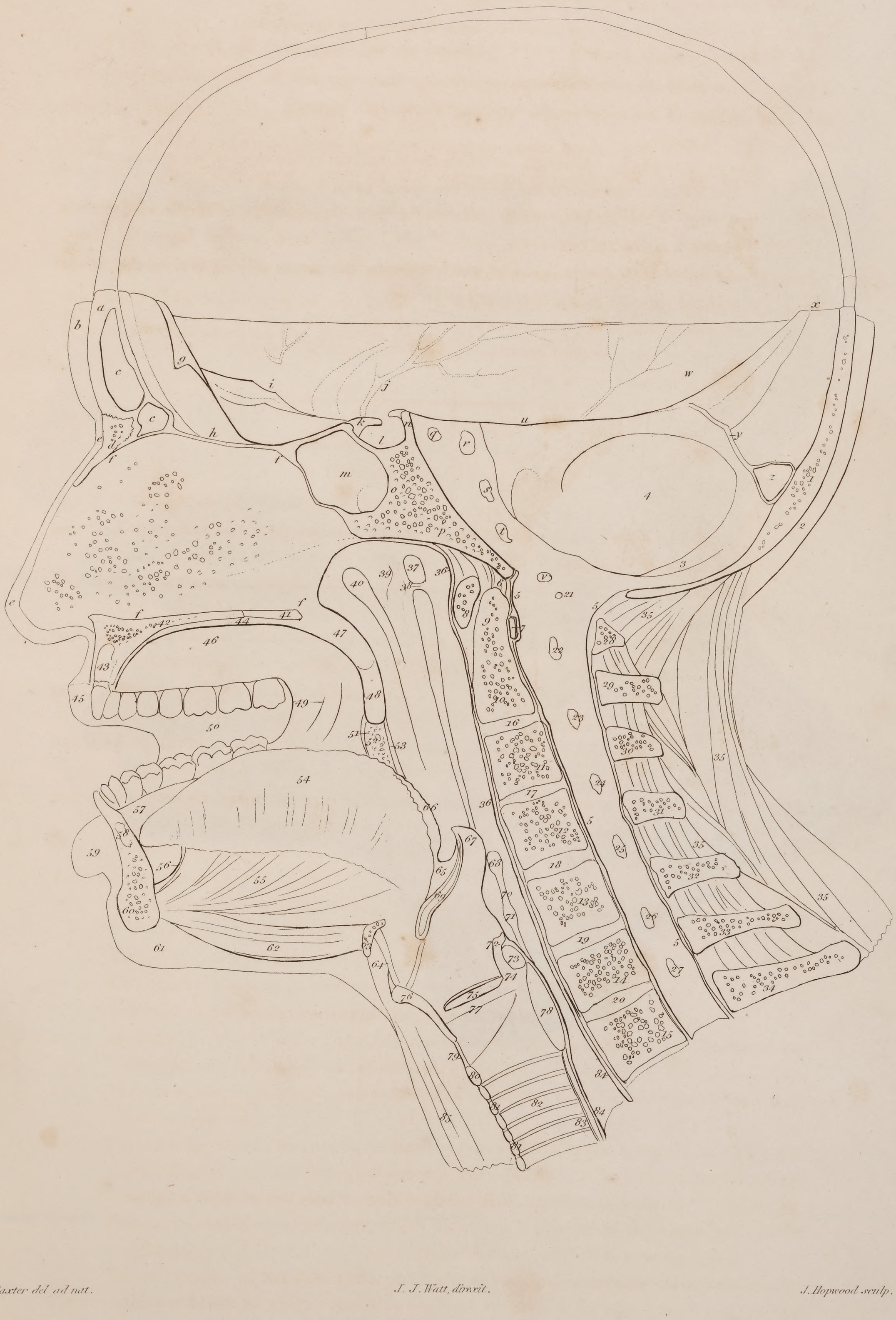
28. Cut edge of the back portion of the first vertebra, or atlas.
29. Cut edge of the spinous process of the second
30. - - - - - - - - - - third
31. - - - - - - - - - - fourth
32. - - - - - - - - - - fifth
33. - - - - - - - - - - sixth
34. - - - - - - - - - - seventh

} cervical vertebra.

35.35.35.35. Muscles of the back of the neck, divided in common with the integuments.

36.36. Cut edge of the pharynx.

37. Sacculus cæcus of the pharynx, on the right side.
38. Membrane sometimes dividing the sacculus cæcus at this part.
39. Eminence caused by a piece of cartilage at the extremity of the Eustachian tube of the right side.



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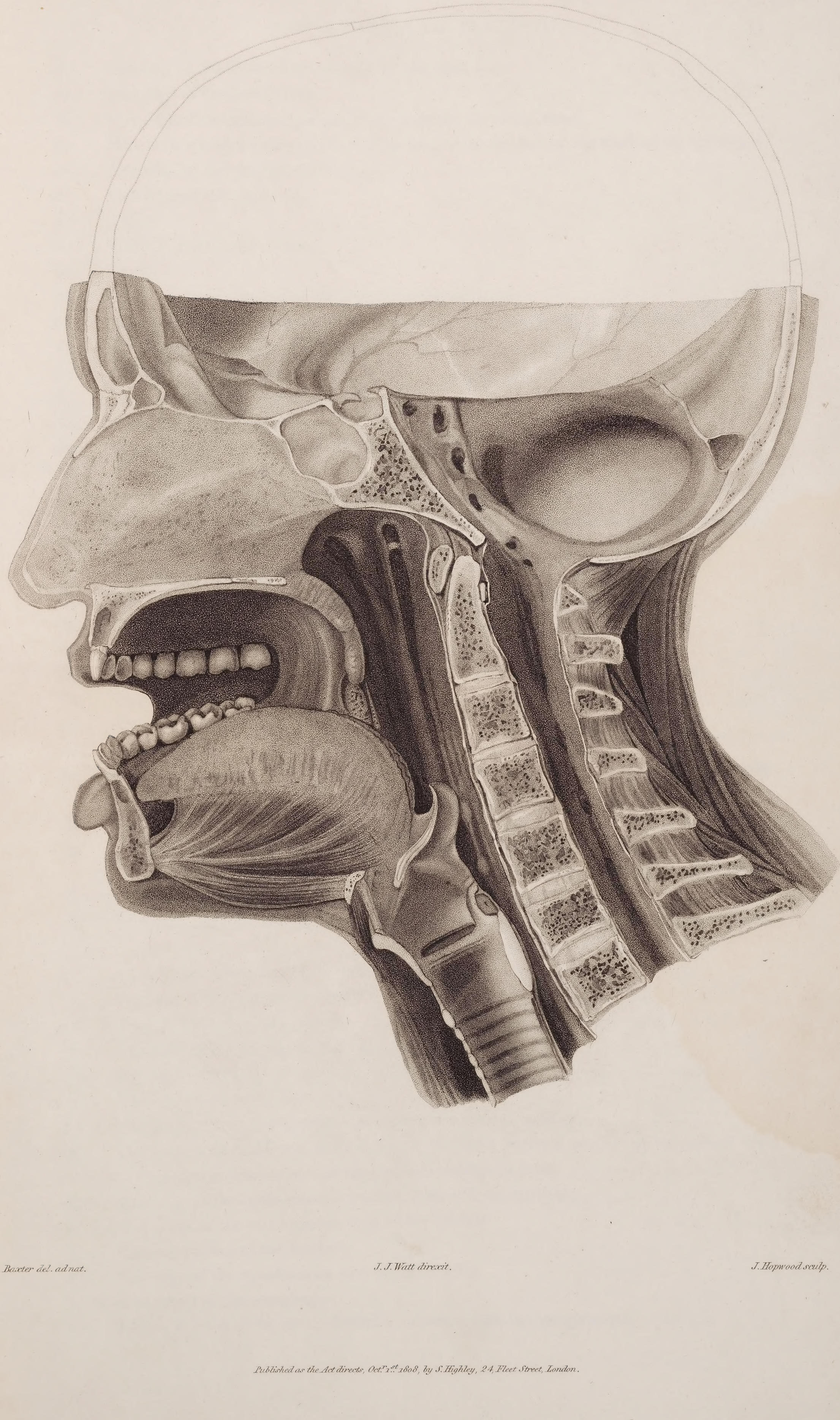

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40. Opening of the Eustachian trumpet of the right side.
41. Cut edge of the palate bone.
42. Cut edge of the palatine process of the superior maxillary bone.
43. Part of the cavity for the reception of the fang of the first left incisor tooth of the upper jaw.
44. Cut edge of the palatine membrane.
45. Cut edge of the upper lip.
46. Palate.
47. Cut edge of the soft palate.
48. Uvula.
49. Folds of the membrane of the mouth on the right side.
50. Internal lining of the cheek on the right side.
51. Glosso-palatine arch of the right side.
52. Tonsil of the right side.
53. Pharyngo-palatine arch of the right side.
54. Cut edge of the tongue.
55. Genio-glossus muscle of the right side.
56. Frenum of the tongue.
57. Internal surface of the alveolar process of the lower jaw covered by the gum.
58. Part of the cavity for the reception of the fang of the first left incisor tooth of the lower jaw.
59. Cut edge of the under lip.
60. Cut edge of the inferior maxillary bone.
61. Cut edge of the integuments and adipose substance under the chin.
62. Genio-hyoideus muscle of the right side.
63. Cut edge of the os hyoides.
64. Cut edge of the ligament which connects the os hyoides to the thyroid cartilage.
65. Frenum epiglottidis.
66. Dorsum of the tongue
67. Epiglottis.
68. Eminence caused by the posterior extremity of the cornu of the os hyoides, on the right side.
69. Cut edge of the epiglottis.
70. Prominent line denoting the situation of the ligament which connects the posterior extremity of the cornu of the os hyoides to the superior cornu of the thyroid cartilage, on the right side.
71. Eminence shewing the situation of the superior cornu of the thyroid cartilage, on the right side.
72. Corniculum of the larynx, on the right side.
73. Cut edge of the arytenoid muscle.
74. Base of the arytenoid cartilage.
75. Ventricle of the larynx, on the right side.
76. Cut edge of the thyroid cartilage, in front.
77. Chorda vocalis of the right side.
78. Cut edge of the broad posterior portion of the cricoid cartilage.
79. Cut edge of the ligament which connects the small anterior portion of the cricoid cartilage to the inferior part of the thyroid cartilage in front.
80. Cut edge of the small anterior portion of the cricoid cartilage.
81. 81. Cut edges of the cartilaginous rings of the trachea.
82. Internal surface of the trachea.
83. Cut edge of the membranous part of the trachea.
84. 84. Cut edges of the œsophagus.
85. Muscles in front of the neck, divided in common with the integuments.

EXPLANATION OF PLATE IV.

THIS Figure represents the left section of the head divided according to the method described in the last plate.

The principal circumstances in which this differs from the preceding plate are that, as the septum remained with the right half, the turbinated bones of the left nostril are here brought into view; and that the tongue has been turned aside from the lower jaw, in order to expose the sublingual gland with its duct. A tooth has likewise been removed from the upper jaw on this side, for the purpose of bringing into view the opening at which the duct of the parotid gland enters the cavity of the mouth. The usual situation of this opening is opposite to the first molaris.

References to Plate IV.

a. Cut edge of the frontal bone.

b. Cut edge of the integuments covering the frontal bone.

c. c. Parts of the left frontal sinus which was composed of two cavities in this subject.

d. Cut edge of the nasal bone of the left side.

e. e. Cut edge of the integuments covering the nasal bone and cartilage of the nose.

f. Irregular surface of the left orbitar process of the frontal bone, upon which the left anterior lobe of the brain is situated.

g. Cut edge of the cribriform plate of the ethmoid bone.

h. Anterior clinoid process of the left side.

i. Cut edge of the posterior clinoid process.

j. Sella turcica, or ephippium.

k. Part of the left sphenoidal sinus.

l. Cut edge of the body of the sphenoid bone.

m. Cut edge of the basilar portion of the occipital bone.

n. Grooves made by the ramifications of the spinous artery of the dura mater on the parietal bone of the left side.

o. Edge of the tentorium, on the left side.

p. Opening placed just under and behind the edge of the tentorium, at which the nerve of the fifth pair enters its canal of dura mater, on the left side.

q. Meatus auditorius internus, or aperture into which the auditory and facial nerves pass, on the left side.

r. Foramen lacerum in basi cranii, or jugulare, through which the nerve of the eighth pair (including the glosso-pharyngeal and accessory portions, as well as the proper nervus vagus) and the lateral sinus pass through the skull, on the left side.

s. Foramen condyloideum anterius, which transmits the nerve of the ninth pair, on the left side.

t. Round opening of the dura mater, at which the vertebral artery enters the cranium, on the left side.

v. Cavity beneath the tentorium, in which the left lobe of the cerebellum is situated.

u. Cut edge of the tentorium.

w. Part above the tentorium, on the left side, in which the left posterior lobe of the brain is situated.

x. Lateral sinus divided.

y. Cut edge of the occipital bone.

z. Cut edge of the integuments covering the occipital bone.

1.1.1.1. Muscles of the back of the neck, divided in common with the integuments.

2. Cut edge of the back portion of the first vertebra, or atlas.

3. Cut edge of the spinous process of the second
4. - - - - - - - - - - - - - third
5. - - - - - - - - - - - - - fourth
6. - - - - - - - - - - - - - fifth
7. - - - - - - - - - - - - - sixth
8. - - - - - - - - - - - - - seventh

} cervical vertebra.

9.9.9.9. Cut edges of the membrane lining the spinal canal.

10. Cut edge of the ligament which connects the processus dentatus of the second cervical vertebra to the occiput.

11. Cut edge of the circular ligament which connects the processus dentatus of the second cervical vertebra to the first vertebra or atlas.

12. Cut edge of the front portion of the first vertebra or atlas.

13. Cut edge of the processus dentatus of the second cervical vertebra.

14. Cut edge of the body of the second
15. - - - - - - - - - - third
16. - - - - - - - - - - fourth
17. - - - - - - - - - - fifth
18. - - - - - - - - - - sixth
19. - - - - - - - - - - seventh

} cervical vertebra.

20. Cut edge of the intervertebral substance placed between the bodies of the second and third cervical vertebra.

21. - third and fourth cervical vertebra.

22. - fourth and fifth cervical vertebra.

23. - fifth and sixth cervical vertebra.

24. - sixth and seventh cervical vertebra.

25. Opening at which the suboccipital or first of the cervical nerves penetrates the dura mater on the left side.

26. Opening for the second
27. - - - - - third
28. - - - - - fourth
29. - - - - - fifth
30. - - - - - sixth
31. - - - - - seventh

} cervical nerve of the right side.

32.32. Cut edge of the pharynx.

33. Sacculus cæcus of the pharynx, on the left side.

34. Membrane sometimes dividing the sacculus cæcus at this part.

35. Eminence caused by a piece of cartilage at the extremity of the Eustachian tube of the left side.

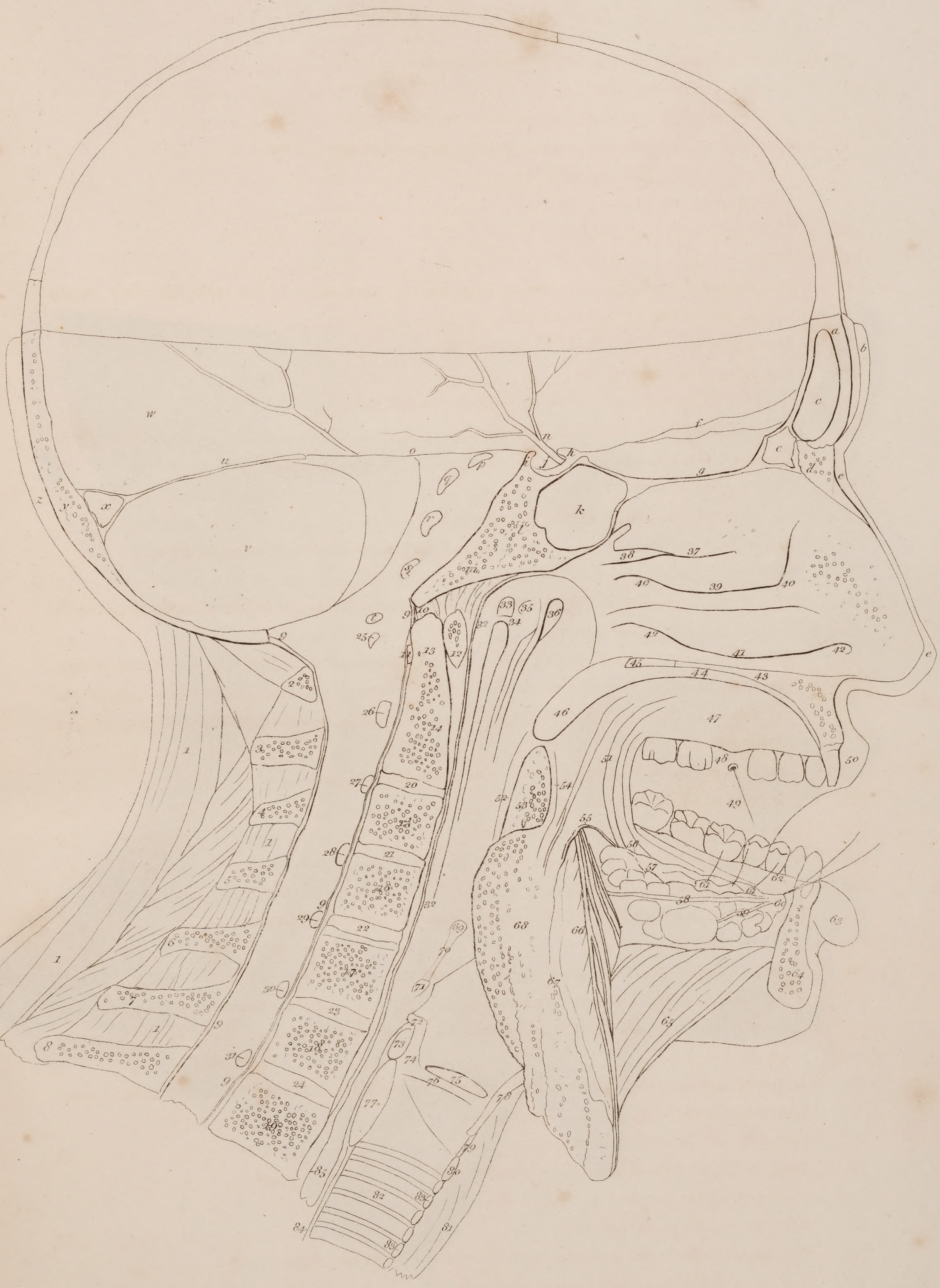
36. Opening of the Eustachian trumpet of the left side.

37. Superior turbinated bone.

38. Back opening of the superior meatus narium.

39. Middle turbinated bone.

40. 40. Front and back opening of the middle meatus narium.
41. Inferior turbinated bone.
42. 42. Front and back opening of the inferior meatus narium.
43. Cut edge of the palatine process of the superior maxillary bone.
44. Cut edge of the palatine membrane.
45. Cut edge of the palate bone.
46. Cut edge of the soft palate.
47. Palate.
48. Opening of the left parotid duct, with a bristle inserted in it, brought into view by the removal of the first molar tooth.
49. Internal lining of the cheek on the left side.
50. Cut edge of the upper lip.
51. Folds of the membrane of the mouth on the left side.
52. Pharyngo-palatine arch of the left side.
53. Tonsil of the left side.
54. Glosso-palatine arch of the left side.
55. Cut edge of the membrane of the mouth.
56. Cut edge of the membrane of the mouth, where it covers the sublingual gland.
57. Sublingual gland.
58. Duct of the sub-maxillary gland passing over the inner surface of the sublingual gland.
59. Duct of the sublingual gland.
60. Termination of the ducts of the sublingual and sub-maxillary glands, in a common orifice.
61. 61. Openings of smaller ducts of the sublingual gland, terminating separately behind the common orifice. N.B. In these, as well as in the before-mentioned ducts, bristles have been inserted.
62. Internal surface of the alveolar process covered by the gum.
63. Cut edge of the under lip.
64. Cut edge of the inferior maxillary bone.
65. Genio-glossus muscle of the left side.
66. Branches of the gustatory nerve.
67. Cut edge of the membrane of the mouth where it covers the tongue.
68. Tongue, with its papillæ.
69. Eminence caused by the posterior extremity of the cornu of the os hyoides, on the left side.
70. Prominent line denoting the situation of the ligament which connects the posterior extremity of the cornu of the os hyoides to the superior cornu of the thyroid cartilage, on the left side.
71. Eminence shewing the situation of the superior cornu of the thyroid cartilage, on the left side.
72. Corniculum of the larynx, on the left side.
73. Cut edge of the arytenoid muscle.
74. Base of the arytenoid cartilage of the left side.
75. Ventricle of the larynx, on the left side.
76. Chorda vocalis of the left side.
77. Cut edge of the broad posterior portion of the cricoid cartilage.
78. Cut edge of the thyroid cartilage, in front.
79. Cut edge of the ligament which connects the small anterior portion of the cricoid cartilage to the inferior part of the thyroid cartilage.
80. Cut edge of the small anterior portion of the cricoid cartilage.
81. Muscles in front of the neck, divided in common with the integuments.
82. Internal surface of the trachea.
83. 83. Cut edges of the cartilaginous rings of the trachea in front.
84. Cut edge of the membranous part of the trachea.
85. Cut edge of the œsophagus.



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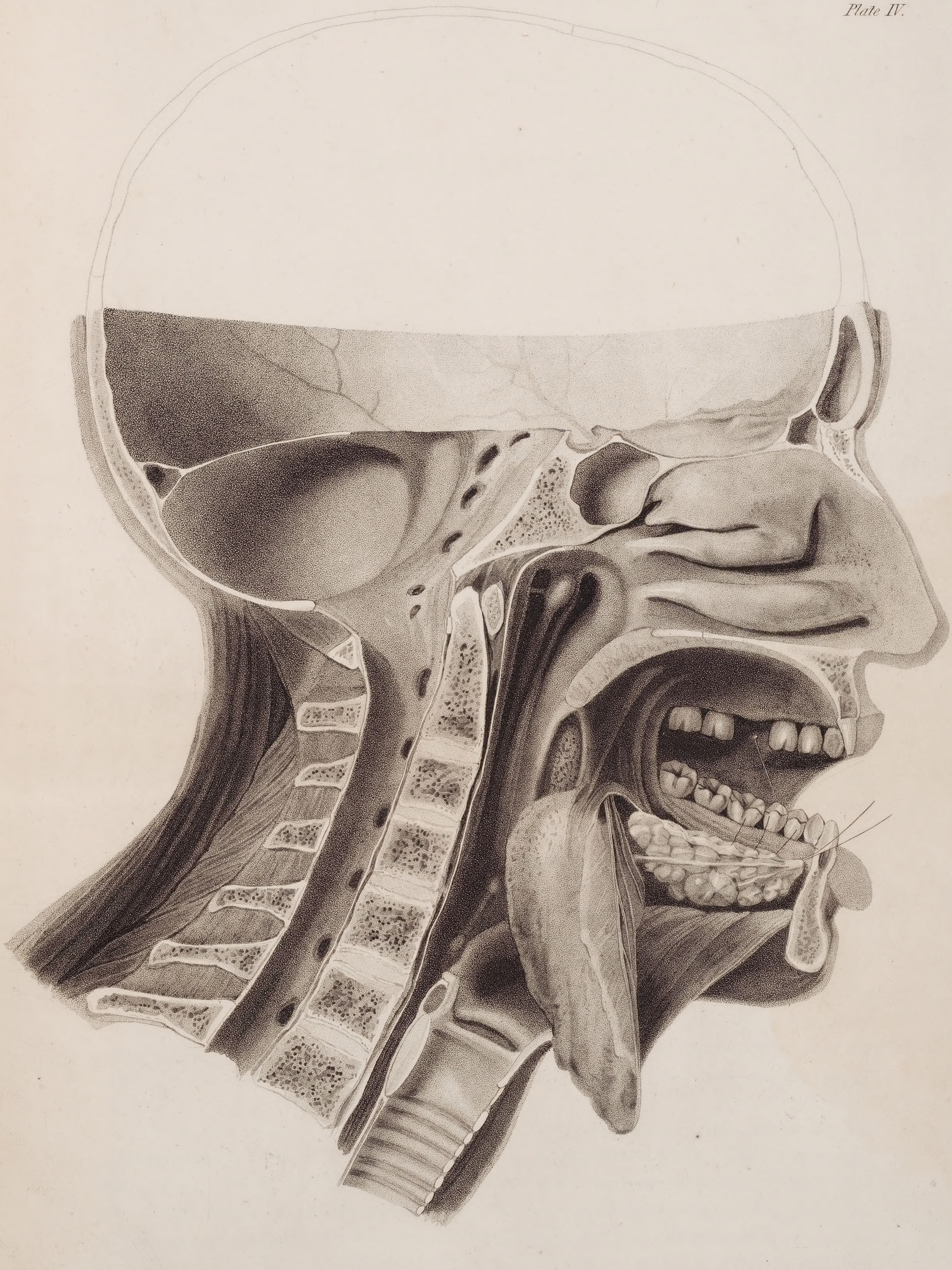

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DESCRIPTION

OF THE

MOUTH, NOSE, LARYNX, AND PHARYNX.

BY MR. W. LAWRENCE.

As it would be altogether foreign to the purpose of the present publication, to enter into minute and laboured anatomical descriptions, I shall confine myself to such a general sketch of the organs and their functions, as will be sufficient to render the plates intelligible.

The nose and mouth, which occupy the front and lower part of the head, and contain the organs of smelling, tasting, and chewing; and the larynx, which is placed on the front of the neck, and forms the instrument by which the voice is produced; are so many cavities distinct from each other, yet all communicating with a large membranous bag, situated against the vertebræ of the neck, and named the pharynx. The most natural arrangement, which we can adopt, in delineating these parts, will be, to consider, in the first place, the cavities of the mouth, nose, and larynx; and then to describe the pharynx, with the various openings by which it communicates with the adjoining organs.

The Cavity of the Mouth is the space included between the lips and cheeks on the front and sides; the palatine arch*, and the soft palate above and behind; and the tongue, and membrane of the mouth below. It opens to the front by a transverse aperture placed between the two lips, and differing in size and figure according to the motions of those parts; behind, it communicates with the bag of the pharynx. The general direction of the cavity, in the erect position of the body, is horizontal; with the former opening placed directly forwards, and the latter backwards.

The circumference of the palate is bounded on its anterior and lateral aspects by the alveolar portion of the upper jaw, containing the upper series of teeth. The corresponding part of the inferior maxillary bone, in which the lower teeth are implanted, projects into the mouth below. When this cavity is shut, the two rows of teeth meet together, and divide it into two parts, having no communication with each other; viz. an outer or front division, situated between the lips and cheeks on one side, and the outer surface of the teeth and their sockets on the other; and an inner or back part, including the space left within the arches described by the teeth and containing the tongue. In the open state of the mouth, these two divisions are connected by the wide aperture left between the two rows of the teeth.

The second figure of the second plate, and the third and fourth plates, exhibit the facts which have been just described.

* By this expression, I mean to denote that portion of the palate which is formed by the superior maxillary and palatine bones; and to distinguish it from the velum palati.

The extent of the cavity of the mouth differs in its different directions. When it is shut, the superior surface of the tongue is in contact with the palate, and the lips and cheeks are applied against the teeth; so that there is no cavity or empty space at all in this condition of the organs. When the process of mastication is going on, the tongue and jaw descend, and the lips and cheeks are distended with the food; thus the cavity is increased in all its dimensions. The perpendicular diameter, which in the quiescent state of the parts was reduced to nothing, becomes more and more considerable in proportion to the depression of the lower jaw. The measure from side to side, in the first-mentioned state, is the distance between the edges of the teeth on each side; and that from before backwards is nearly the same in extent. Both these diameters will be affected considerably by the motions of the lips and cheeks, and will be greater or smaller according to the distension of those organs.

The cavity of the mouth is lined by a soft and vascular membrane, continuous at the front aperture with the common integuments of the face, extended behind into the pharynx; and differently organised in different parts of its course. From the loose and tumid edges of the two lips it is produced over their inner surface, and that of the cheeks: bestowing a soft lining on both of these parts. The membrane is reflected from the back of the lips to the outer alveolar plate of the upper and lower jaw-bones, in such a way as to leave to the former organs a free power of motion in every direction. The connexion, however, is more close just in the middle, where a small fold of membrane, produced from either lip to the bone, limits the extent to which the lip can be moved away from the teeth: these duplicatures are named the frena of the lips. After covering the outer alveolar plate of the two jaws, the membrane approaches the necks of the teeth, assumes a greater firmness of texture, and forms the gums. On the alveolar edges of the maxillary bones, and consequently in the middle of that part which forms the gum, the membrane is perforated by several holes, equal in number to that of the teeth; to the necks of which organs it adheres closely at the margins of these perforations. It is then continued over the inner or posterior alveolar plate of the two jaw-bones; affords a covering above to the bony palate, and is prolonged over the under surface of the soft palate, at the posterior or loose edge of which it becomes continuous with the pituitary membrane of the nose. From the cheek it goes over the ramus of the jaw, and is continued with the membranous fold that passes from the soft palate to the tongue (the glosso-palatine arch).

After covering the inner alveolar plate of the lower jaw, it passes to the under surface and sides, and then to the upper part of the tongue. Opposite to the symphysis of the bone, and just over the attachment of the genio-glossi, it makes a fold, attached on one side to the posterior surface of the anterior and middle part of the jaw, and on the other to the middle of the under surface of the tongue; confining that part to its proper situation, and limiting its motions; and therefore distinguished by the name of frenum. In other situations, the membrane is produced loosely from the bone to the tongue; and it covers on each side, towards the front, a small oblong eminence formed by the projection of the sublingual salivary gland. From the back of the tongue the membrane is extended over the epiglottis and forms three folds, connecting that organ to the surrounding parts.

The moveable and nearly hemispherical covering, consisting of common integuments on the outside, of a soft vascular membrane internally, and having a considerable number of muscles, together with more or less fat, and numerous glandular bodies interposed between these;---extended from the cheek-bone, upper jaw, and front of the nose, so as to cover the two rows of teeth, and attached below to the whole length of the alveolar portion of the lower jaw;---and possessing a middle transverse fissure parallel to the teeth, and corresponding to the interval of the two rows, but much shorter than that interval;---constitutes the *lips* and *cheeks*. The *lips* are the two moveable portions of the above-described production, placed before the front teeth, bounding the mouth at its anterior part, and forming, by their red and softly-swelling edges, the margins of the opening of the mouth. The upper-lip includes the part placed between that opening and the nose; the lower is the portion between the same orifice and the lower jaw.

Besides the importance of these parts, considered with regard to the influence which they exert on the general expression of the countenance, they are immediately concerned in the introduction of food into the mouth, in mastication, and in the pronunciation of articulated sounds. They are united at the two corners of the mouth by acute angles, named their commissures. Their loose edge, which is their thickest part, forms the point of continuation between the mucous membrane of the mouth, and the common integument.

They consist externally of skin, remarkable for its thinness, as well as for the hairs which grow in it, and form the beard, one of the great characteristic differences between the male and female subject. This is succeeded by a large assemblage of muscular fibres, giving to the part a power of motion in every direction. The muscular layer is followed by a considerable number of mucous glands *(glandulæ labiales)* forming small granular bodies, projecting towards the mouth, where they are covered by the mucous membrane, and possessing excretory ducts which perforate that membrane.

The mucous lining of the lip resembles that of the mouth in general: it is very vascular, and becomes of a general and deep red from minute injections. The red swelling part, which forms the very opening of the mouth, is distinguished from the common skin, externally by a clearly defined line, and from the mucous membrane on the inside. It is this part which forms, by its clear transparent redness, so beautiful a contrast with the pearly whiteness of the teeth. It possesses cuticle, which often separates in dry and ragged portions, particularly in cold weather. The cutis at this part is furnished with numerous villi, indicating a high degree of organization; and the pleasurable physical sensation, experienced in kissing, corresponds with this structure. The entire want of fat, or the very small quantity, which does exist in the lips, occasions these parts to retain almost constantly the same thickness; which is much more favourable to their functions, than if they had changed according to the embonpoint, or thinness of the body in general.

The external opening of the mouth is the space left between the two lips. Its direction in the quiescent state is transverse; and it does not then exist as an opening, since the two lips are in contact.

The free power of motion, which the sides of the aperture possess in every direction, renders it susceptible of very numerous varieties, both of size and figure. In the most contracted state, it forms a small transverse groove with corrugated edges. It may be extended laterally by the separation of both corners, until those parts are brought opposite to the last bicuspis, or first molar tooth. In the perpendicular direction, it is affected chiefly by the depression of the lower jaw; but it may also be changed by the motions of the lips merely, which can be separated to a considerable distance, their edges being at the same time turned out, and a larger surface of the red part being exposed.

The cheeks, forming the lateral boundaries of the mouth, are parts of similar organization to the lips, with which indeed they are entirely continuous, so that there is no natural distinction between them.

Externally, their extent is not defined by any precise limits; but those usually assigned are the cheekbone above, the base of the lower jaw below, the commissure of the lips in front, and the projection of the masseter behind. Towards the mouth, on the contrary, they are bounded precisely, both above and below, by the reflexions of the mucous membrane from their surface to the jaw-bones; behind by the folds of membrane, descending from the velum palati, and in front, by the commissures of the lips. Their thickness depends on the quantity of fat which they contain, which is subject to considerable variety. The external structure of the cheek consists of a thin and delicately organized skin, from which there are but few hairs growing, particularly towards the middle. In this part it is particularly distinguished by its capillary system, through which a large quantity of blood constantly circulates in young and healthy persons. This being liable to sudden and accidental changes, either of increase or diminution, becomes an involuntary index of the affection of the mind; whether, as in the pleasurable emotions, and likewise in anger, indignation, &c. its momentary distension gives rise to that

vivid redness of the cheek, which extends, in a diminished degree, to other parts of the face; or, as in the depressing and sorrowful passions, the same parts become overspread with a more or less sudden paleness. The capillary system of the cheeks is also variously affected in disease, where it is sometimes emptied of its blood, and in other cases distended with an unusual quantity. Under the integuments of the cheek we have the zygomaticus muscle, covering a considerable quantity of soft fat, contained in a loose cellular texture. This facilitates the motions of the buccinator and neighbouring muscles, and augments considerably the transverse diameter of the face. It is absorbed very rapidly in various diseases, and soon replaced in a state of convalescence; so that the figure of the cheek becomes an index of the general health. Under this fat, the whole surface of the cheek is covered by the buccinator muscle; which is lined internally by the mucous membrane of the mouth, several round mucous glands *(glandulæ buccales)* being interposed between that lining and the muscle.

The palate, composing the upper surface of the mouth, is nearly of a parabolic figure, extending rather more in length than in breadth. Its position is nearly horizontal in the ordinary erect attitude; and as its bony structure renders it completely motionless of itself, it offers a fixed point of resistance to the tongue, in the motion of articulation and deglutition.

We must distinguish in the bone the alveolar portion, and the proper palatine arch. The former constitutes a parabolic projection, which limits the palate at its anterior and lateral aspects, and contains on its inferior surface, the openings of the alveoli. This belongs entirely to the superior maxillary bones, and surmounts the upper row of teeth, which borders the palate. The proper palatine arch is made up of the horizontal portions of the superior maxillary and palatine bones.

The palate, when considered in its perfect state, presents a very considerable concavity towards the mouth. In the child, which has not yet cut its teeth, and where consequently the alveolar process is not yet formed; and in the old subject, where these organs, together with the bone in which they were implanted, have been lost, this part of the mouth presents a very different appearance from that which it has in the intervening periods. It exhibits a nearly level surface, instead of a considerable concavity. The lower jaw-bone undergoes a similar change in advanced age; hence the cavity that holds the tongue becomes very considerably diminished, and the motions of that organ in articulation and chewing are proportionally impaired.

The membrane of the palate presents a very different structure in the alveolar and palatine portions of the bone. In the former situation, it constitutes in the fœtus a thick, dense, firm, and whitish layer, covering the alveoli and rudiments of the teeth, and forming a resisting surface capable of the efforts required in that species of mastication, which is then exercised. This is pierced by the teeth, when they appear in the mouth; and its sides, adhering round the neck of the tooth, constitute the gum. When the teeth and alveoli are lost, the perforations of the gum are destroyed by the closing of their sides, and a similar hard white substance to that of the fœtus again occupies the alveolar edges of the jaws, and affords considerable assistance in old age in the act of mastication.

The palatine portion of the membrane of the mouth is dense and compact in its structure, and adheres very closely to the bone. It is divided by a middle line into two halves, more perceptibly in the fœtus than in the adult. Its surface is irregular, and usually marked by slight transverse eminences towards the front. It is continued behind into the anterior surface of the soft palate. It possesses several mucous glands, similar in structure to those already noticed in the lips and cheeks, and known by the name of *glandulæ palatinæ*. The excretory ducts of these open conspicuously on the surface, and are most numerous towards the velum palati.

The posterior boundary of the mouth is formed by a fleshy and moveable curtain, extended from the back of the palatine arch into the pharynx, and called the *soft palate*

(velum-palati, palatum-molle). Thus it is placed above the opening, which leads from the mouth into the pharynx, and is separated by that aperture from the base of the tongue. Its figure is nearly quadrangular; and it possesses two surfaces, of which one is anterior, and the other posterior; and four margins, of which two are lateral, one superior, and the other inferior. The anterior surface, of the velum palati, which is turned towards the tongue, and faces downwards and forwards, is smooth and uniform, gently concave, and presenting several small openings of the mucous ducts; the posterior, which is directed upwards and backwards, has a considerable elevation on each side, arising from the course of the levator palati muscle, and a smaller one in the middle from the azygus uvulæ. The superior margin is fixed to the back edge of the palatine bones, and this is the thickest part of the velum.

The inferior border hangs loosely into the pharynx, and is divided into two parts by a conically shaped body, projecting exactly from the middle of the velum, and named the uvula. The broader part of this organ is rather flattened, and is placed upwards; the smaller portion is more cylindrical in its figure, and is directed downwards, terminating in an obtuse point. It varies in length in different individuals; and in the same person, according to the state of its elevator muscle. It sometimes hangs down so as to touch the tongue, and when it is thus permanently relaxed, it causes a very disagreeable irritation on that part. In its natural state it points nearly to the foramen cæcum of the tongue; and is therefore considerably in front of the epiglottis. It is peculiar to the human subject, and to animals of the monkey kind; in other instances the lower edge of the soft palate is nearly straight. The presence of the uvula causes the corresponding part in man to form a double arch.

The lateral edges of the soft palate are continued with the tongue and pharynx, by two membranous and muscular folds. These are united at their origin, which takes place at the outer corner of the lower edge of the palate: but they separate from each other as they descend. The anterior *(glosso palatine)* terminates on the side of the base of the tongue; the posterior (*pharyngo-palatine*) is lost on the side of the pharynx. A triangular space, formed by their separation, contains the tonsil.

By looking into the throat of a living person, we gain such a view as is delineated in the second figure of the second plate. The contracted opening, by which the mouth communicates with the pharynx *(isthmus faucium)* formed chiefly by the parts now described, is there brought into view. It is bounded below by the root of the tongue; above by the lower edge of the soft palate, which is divided into two arches by the uvula; and at the sides by the glosso-palatine folds of membrane continued from the palate to the tongue. Just behind these the convex surface of the tonsils is discernible. The back view of the same aperture, or that which is seen from the bag of the pharynx, is exhibited in the first plate, where we see, as from the front, the tongue below, and the double arch of the palate, with the uvula above. But the sides are here formed by the pharyngo-palatine folds, produced from the velum in a perpendicular direction to the sides of the pharynx. The convexity of the tonsil is also conspicuous in this view. The third and fourth plates shew the parts in their lateral aspect: the fourth exhibits most distinctly the union of the two folds above, their separation as they descend, and the vacancy between them occupied by the tonsil.

The soft palate has two membranous surfaces, of which the anterior is produced from the membrane of the palate, and the posterior from the pituitary membrane. These are continued into each other at the loose edge of the curtain. The palatine portion of the membrane covers a thick layer of granular bodies, which pour out a copious mucous secretion from numerous pores, easily distinguishable by the naked eye. The uvula contains a mass of similar glands. The muscles of the palate contribute also to its substance. The azygus uvulæ occupies the centre, and the levator with the circumflexus palati are expanded

in the lateral portions of the velum. The folds produced from the palate to the tongue and pharynx contain also muscular fibres.

The remarks which we have to make respecting the motions of the soft palate, and the effect which these produce on the isthmus faucium, will be given in the description of the pharynx.

The tonsils or amygdalæ are bodies of a glandular nature, and secrete a mucous fluid, which is poured out from numerous large openings on their external surface. These glands occupy the space left between the glosso-palatine and pharyngo-palatine folds of membrane, extending above to the point at which these folds are united, and below to the base of the tongue. The constrictor isthmi faucium muscle lies in front of the gland, and the palato-pharyngeus behind. When the tonsils are inflamed, they are pressed between the two muscles just mentioned, in the act of deglutition, and hence arises the pain experienced under these circumstances. The form of the tonsil, which is subject to much variety, approaches most nearly to the oval figure, with the long axis placed perpendicularly; and the size is tolerably well expressed by the common comparison to an almond, from which the name of amygdala has been derived. They are often divided into lobes more or less distinct from each other. Their colour is rather grey, and their texture soft. The convex portion of the gland, which projects between the two folds of membrane, has several openings on its surface, leading into small cells hollowed out in the substance of the tonsil, and lined by continuations of the membrane of the mouth. The mucus secreted by the vessels of the part is deposited in these cells by the excretory tubes, from which it may be pressed out in the dead subject. This fluid, which is transparent in the healthy state, becomes white and opaque in certain inflammatory affections; and then lodging in the superficial cells gives the deceptive appearance of a small ulcer or slough in the part. Smaller glandular masses, of a similar structure and office, exist, as we have already mentioned, in considerable numbers in the substance of the velum-palati and uvula; and have their excretory ducts forming very conspicuous openings on the surface of those parts. These are described by anatomists under the epithet of glandulæ palatinæ. The back of the tongue is furnished likewise with several small roundish and flattened prominences, which give it an irregular and tuberculated appearance in this situation; these are also mucous glands called *linguales*; and they discharge their fluids by an opening which is conspicuous in the centre of each tubercle. The general figure and appearance of these may be discerned in that part of the tongue which is exhibited in (Plate I.) The use of this mucous apparatus, existing in such abundance in every part of the isthmus, or contracted aperture, which forms the communication between the mouth and pharynx, seems very obvious:—that of furnishing a lubricating fluid, to facilitate the passage of the food, particularly when it is of a dry nature.

The *tongue* constitutes the organ of taste, but is by no means confined to that office: we consider it here as forming a part of the mouth, and as concurring, by its motions, in the processes of mastication and deglutition. It is also most immediately and essentially concerned in the production of articulated sounds. Besides the offices now enumerated, it performs a most important part, in the earlier period of our existence, as an indispensable agent in the act of suction;—as the means therefore by which we derive our first nourishment. In addition to the claims which it prefers, from all these considerations, to the attention of the philosopher and the physiologist, it is still further recommended to the investigation of the practitioner, as the index by which the diseased state of the digestive organs may be most certainly ascertained, and as the seat of a most alarming cancerous affection, for which the use of the knife is often required.

The tongue occupies the lower part of the mouth; is bounded in front by the anterior teeth of the two jaws, behind by the epiglottis, above by the palate, and below by the os hyoides and its muscles. Its bulk and form are subject to much variety, as it admits of elonga-

tion and retraction by the action of its various muscles. It is smaller in size and loose towards the front; here it terminates by an obtuse end, named its apex. At the back part it becomes broader and thicker, and is closely attached to the surrounding parts; this is called the basis or root of the tongue. The *superior surface* which is perfectly loose and unconnected in its situation, presents a slight and general convexity, divided, however, by a superficial groove running along its middle, into two equal halves. These are lost towards the sides in the two *edges* of the tongue, which correspond with the interval between the two rows of teeth, and like the whole superior surface, are free from all kind of attachment.

The lateral portions of the organ which are in contact with the inner surface of the lateral teeth, and with the inner alveolar plate of the lower-jaw, are flattened in their form, and are unconnected in their situation. The inferior surface of the tongue cannot be very clearly defined, as we cannot exactly point out the boundaries between the tongue itself and its muscles. It is connected below, throughout at least two thirds of its under surface, in the space left between the two lateral divisions of the lower jaw-bone, with several muscles, arising from the jaw, styloid process, and os hyoides, and continued into the substance of the organ, which they have the power of moving in every direction, in the cavity of the mouth. It is the intermixture of these muscles with the lingual nerves and vessels, and with a large mass of a very peculiar muscular fibre, called the lingualis muscle, that forms the substance of the tongue. At the front of the organ, the inferior surface is loose and unconnected, except towards its middle, where it is tied by the frenum to the lower jaw, at the posterior surface of its symphysis. The back edge of the tongue is connected to the epiglottis by three folds of membrane.

The membrane of the mouth, after covering the inner alveolar plate of the lower jaw, is produced over the projecting portion of the sublingual gland, and then arrives at the inferior surface and sides of the tongue; from which it is continued to the upper convex part of the organ. In the former situation it is smooth like the lining of the cheeks: but in the latter it forms a most rough surface, presenting innumerable prominences named papillæ, and considered to be the immediate organs of the sense of taste.

The cavity of the mouth, which has now been described, forms one of the passages for the admission of air into the lungs in inspiration. That fluid traverses the anterior and posterior openings of the mouth, and thus enters the pharynx; from which it immediately passes into the larynx. By the expulsion of the air from the lungs, through the rima glottidis, the voice is formed; and this, being modified as it goes through the mouth by the tongue, lips, &c. forms articulated sounds or speech.

Mastication. The mastication of the food, or its reduction to such a consistence as renders it fit to be swallowed, takes place in the same cavity.

There is some muscular exertion at the entrance of the food into the mouth: the lips are separated, and slightly everted, exerting sometimes a kind of prehensile power, the lower jaw gently carried downwards. Liquids are taken in by the united agencies of the lips and tongue, which are observed to exert themselves in two ways. The first method is that of suction, and is almost peculiar to the child. The nipple of the mother is embraced by the lips, which contract closely round it from the action of the orbicularis. The tongue formed into a longitudinal channel, by the action of the genioglossi, is applied in front, to the nipple, receives the fluid which comes from that part, and transmits it to the pharynx. When the lips and tongue are thus placed, the enlargement of the chest forms a vacuum in the mouth, and the pressure of the external air on the surface of the breast forces out the milk. We can also drink by immersing the lips in a fluid; and the mechanism is the same, in this instance, as the preceding. This is the way in which the horse drinks. The other method is by applying the lips to a vessel containing the fluid, in which case also the tongue forms a channel. Here the fluid passes into the mouth chiefly by its own weight, as we in a manner pour it in from the containing vessel.

There is a third possible method of taking liquids; but it is very seldom employed; viz. by opening the mouth widely, throwing back the head, and pouring them into the throat. The food, whether solid or fluid, is retained in the mouth by closing the aperture, and applying the lips and cheeks against the teeth. It is propelled into the back part of the mouth by means of the lips or cheeks pressing on it, and is moved about into every part of each division of the cavity, by the wonderfully quick and varied motions of the tongue, which, by the elevation of its sides, is formed into a sort of cup for that purpose. Or its point is passed between the teeth to clear the food from the corners and sides of the cavity. At the same time the teeth are either brought together perpendicularly, so as to divide the food by the act of biting; or the inferior molares, by the lateral motions of the lower jaw, grind the alimentary substance against the superior ones, which remain immoveable. The different portions are collected, and repeatedly subjected to this action by the motions of the tongue and cheeks; and when sufficiently reduced, it is placed in a mass on the superior surface of the tongue, previously to swallowing.

This mechanical trituration is of the greatest importance in preparing the food for the action of the digestive organs. For there is no force applied to the aliment in the stomach, or intestines, that can be at all considered as equivalent to the effect of mastication. It is well known that the skin of a grape is not broken in its passage through the whole alimentary canal. Imperfect mastication must therefore much injure digestion; and hence old persons digest badly, unless they cut their food minutely, so as to resemble the effect of chewing. "I can easily believe," says a great physiologist, "that a much smaller quantity of food would afford a sufficient proportion of nourishment, if it were more completely chewed. Hence nature has attached a great pleasure and enjoyment to the performance of this process: and I have found the driest bread become sweet and grateful to the palate, when long and thoroughly chewed." Haller, Elem. Phys. t. 6. p. 40.

Salivary Glands. The process of mastication, if it were performed on the food alone, would reduce it to a dry, or at least to a very tenacious mass, that could not be moved about in the mouth for the purpose of complete trituration, without clogging the teeth very much, and adhering very unpleasantly to the surface of the parts; and that could not certainly be swallowed without extreme difficulty. These sources of inconvenience are obviated by the salivary and other glandular apparatus placed in the neighbourhood of the mouth, and furnishing large quantities of fluid for the purpose of moistening the food to the requisite degree. The utility of the liquor, poured into the mouth from these glands, may be estimated from the inconvenience experienced when it is too small in quantity. When we are eating very dry food, as mealy potatoes, they absorb the saliva very rapidly, and require so much dilution, that the fluid is not supplied in sufficient abundance: a difficulty is then experienced in chewing; and the morsel, which has not been duly moistened, often stops in the fauces, producing a sense of suffocation, and passing down to the stomach very slowly.

The salivary glands are so situated as to experience a mechanical compression by the motions of the jaw, tongue, and other parts concerned in mastication: this increases their secretion, and leads to the production of the saliva in large quantities at those times when its presence in the mouth is particularly needed. The openings of the salivary ducts are seen in these plates: that of the parotid gland is opposite to the first molar tooth of the upper-jaw. The excretory tube of the submaxillary gland, being previously joined by a large branch from the sublingual, opens at the side of the frenum of the tongue; and some smaller tubes from the latter gland terminate on the longitudinal prominence situated under the tongue.

Passage of the food into the pharynx. The masticated mass is supposed to be placed on the dorsum of the tongue, which is extended laterally, and has its margins drawn up by the styloglossi, for the purpose of holding it more conveniently. The muscles of the lips and cheeks close the mouth in every direction; and the lower jaw is also elevated, to afford a

fixed point to those muscles which draw up the os hyoides. The food cannot, therefore, escape in any direction. The apex of the tongue is applied against the palate, so that the whole tongue represents an inclined plane, facing backwards and upwards; the rest of the organ is brought successively in contact with the roof of the mouth from before backwards, and the food is thereby forced through the isthmus faucium into the pharynx. These motions are performed by the lingualis and styloglossus. The latter muscle, together with the stylohyoideus and posterior portion of the digastricus, carries the whole tongue backwards, so that it forces the portion of food into the pharynx, and opposes any attempt at a return. The part which the tongue has to perform, is not so great in the act of drinking: the power of suction there aids the passage of the fluid, which runs along a channel formed in the dorsum of the tongue; that organ is, however, carried backwards in a certain degree, to convey the liquor into the pharynx. The further progress of the aliment in the pharynx, and the action which it undergoes in that cavity, cannot be understood until the parts have been described.

Cavity of the Nose. The bony hollows in which the olfactory membrane is expanded, in which the sense of smelling is carried on, and through which the atmospheric air passes on its way to the lungs, are partly situated between the two orbits, and partly below them. They commence on the front of the face by two small openings, which have a very different appearance in the skeleton and the recent subject. In the former there is a single heart-shaped aperture, with the broadest portion below, and the narrowest above. It is formed by the superior maxillary bones at the lower part and sides; by the ossa nasi above. The figure of the part is quite altered by the addition of certain cartilages, which form the *nose*, in the popular acceptation of that term. A large piece is extended on either side from the margins of the bone, and is called the ala nasi. This is moveable, and admits of expansion or dilatation, and of contraction. Another portion is placed in the middle; so as to divide the space left between the alæ into two oval apertures, which form a narrow and contracted entrance into two cavities of considerable size and extent. The sides of these apertures, being formed of cartilage, are maintained in a permanently open state; which is necessary, in order to afford a constant free passage for the air into the lungs.

The cavities of the nose communicate behind with the bag of the pharynx, by two large oval apertures (*choanæ narium*), the perpendicular diameter of which is, however, considerably less than that of the nose in general. The right and left openings are separated by the posterior oblique edge of the vomer; their upper margin is formed by the body of the sphenoid bone, the lower by the back edge of the palate bone, and the outer by the internal pterygoid plate.

The nose is bounded above by a kind of arch, of which the middle is made by the cribriform plate of the ethmoid bone; the anterior portion by the nasal bones; and the back part by the body of the sphenoid bone, on which are observed the openings of the sinuses hollowed out in the centre of that bone.

Through the cribriform plate, the ignorance of the vulgar supposes that the nose and skull communicate; and that the impurities of the brain run off by this passage, to be discharged from the nose. The nostrils are bounded below by the horizontal portions of the superior maxillary and palatine bones; which form the limit between the nasal cavity and the mouth.

The nose is divided by a perpendicular broad and flat partition (*septum narium*) into two nearly equal cavities, the right and left nostrils. This partition is smooth and, generally speaking, level; but it often deviates with a slight obliquity towards the right or left nostril, so as to enlarge one cavity and contract the opposite proportionally.

The septum is formed above, by the nasal plate of the ethmoid bone; behind and below, by the vomer; in front, by a large piece of cartilage. It is attached at the upper part, along the middle of the cribriform plate. In front it may be divided into two

portions; an upper one, resting on the middle nasal suture; and a lower, forming the unconnected edge which divides the anterior openings of the two nostrils. Below it is implanted along the whole length of the middle palatine suture; and behind it is again divided into two portions; an upper one, attached to the middle anterior portion of the body of the sphenoid bone; and a lower unconnected edge, dividing the posterior openings of the nares.

The external surface of the nostril, which is opposite to the septum narium, presents a very irregular appearance, in which we notice various bony prominences, and winding cavities left between them; arising chiefly from the ethmoid and inferior turbinated bones. The three convexities exhibited in this part of the nose are the three turbinated bones, or *conchæ narium*. Of these the superior is the smallest; the middle is next in size; and the inferior is the largest. The two first, which are portions of the ethmoid bone, are separated from each other only towards the posterior part; they unite into one bony plate in front, and this plate is attached above to the cribriform lamella. The inferior concha is a distinct bone.

All the three conchæ are convex on the surface which is turned towards the septum, and concave on the opposite aspect; they are all of an elongated figure, and the long axis of the two lowest is placed parallel to the horizon, so that one end looks directly forwards, and the other backwards. In the position of the superior, there is often some obliquity: its anterior end pointing rather upwards, and the posterior downwards. Each concha has a superior fixed margin, attached to the side of the cavity, and an inferior loose one, of a rounded form hanging unconnected into the nose. The intervals between these bones are called the *meatus*, or, *canales narium*. Of these, the inferior is the largest; and is formed between the concave surface of the lower turbinated bone, and the bottom of the cavity. Into this the nasal duct opens by a simple aperture. The middle meatus is formed between the inferior and middle conchæ; and the frontal and maxillary sinuses open into it. A peculiar prominence of the bone gives to the latter opening a kind of valvular structure.

When the middle concha has been detached, a thin plate is exposed, unconnected at its upper edge, behind which a probe can be passed obliquely downwards and outwards into the antrum. The structure is therefore particularly unfavourable for the discharge of fluids, contained in that cavity; as the opening of communication enters the highest part of the antrum, and the nature of the passage is valvular and indirect. The lower portion of the frontal sinus contracts into the shape of a funnel; and it opens into the nose behind the same plate, which belongs to the aperture of the antrum.

The superior and smallest meatus is the space between the middle and superior bones; it receives the openings of the ethmoidal and sphenoidal sinuses.

The upper meatus is only open towards the back of the nose, while the middle and inferior are open before as well as behind.

The antero-posterior diameter of the nose is the most considerable in its length. It is largest at the middle of the cavity; rather smaller below, and considerably contracted above. The perpendicular diameter is greatest in the middle of the nose, and is much diminished both towards the anterior and posterior parts; it is the smallest just at the front and back openings. The transverse measurement is the least of all; and becomes gradually smaller from below upwards: it is reduced to a very insignificant quantity near the cribriform plate. The extent of the cavity in this direction will be best understood by the sections exhibited in Plate II. Fig. 1, 2; which will convince the student that the application of ligatures to polypous tumours in the nose must be much more difficult than he would expect to find it according to the statement of surgical writers; in short that it is an operation, which has been more frequently described than performed.

The cavity of the nose appears so inconsiderable in a vertical section, made at right angles to the septum, that we readily understand how the passage of the air through this

part becomes impeded, and even totally obstructed under circumstances of disease. The mucous membrane is particularly liable to inflammation, in which it swells and becomes spongy; and in this swollen state fills the cavity so entirely, that no air can pass through it. This effect happens in a greater or less degree in every instance of common cold, and is often very unpleasant from compelling us to keep the mouth open during sleep for the performance of respiration.

The cavity of the nose becomes of still greater extent, if we consider it as including the sinuses, whose openings have been already mentioned. The largest of these are the hollows formed in the superior maxillary bones, and named the *antra* or *maxillary sinuses*. A section of them, exhibiting their magnitude and relative position with respect to the nose and orbits, is delineated in the first and second figures of plate II. It will be understood from this figure, that the antrum is bounded above, by the lower surface of the orbit; below, by the alveolar process of the upper jaw, and by the palate; externally, by a thin plate of the upper jaw, strengthened above by the attachment of the os malæ; and internally, by a thinner lamina, constituting its boundary towards the nose, and having the inferior turbinated bone attached.

The bony parietes of the antrum are mostly slender, and consequently the superior maxillary bone does not possess so much strength and compactness of structure, as an external view might lead us to suppose. The partition between this cavity and the orbit is very thin; and the bone is also very slight in the tops of those conical cavities, which hold the fangs of the teeth; where indeed it is sometimes entirely wanting, so that the point of the fang appears uncovered in the antrum. Hence, when a tooth has been drawn, the pointed end of a probe will readily perforate the upper part of the socket, and enter the maxillary sinus, so as to give issue to any fluid accumulated in that cavity. The surgical student should attend particularly to this point; he should observe how directly the back teeth are placed under the antrum; and what a depending opening a perforation of their sockets would furnish. He should also learn what particular teeth are placed under the sinus; he will find that the two bicuspides, and three molares occupy this position: and that, while the former are situated rather too forward, for operating conveniently, insomuch, that it would be necessary to direct the instrument obliquely backwards; and to penetrate through a greater thickness of bone; and the dens sapientiæ is too far back in the mouth; the sockets of the two front grinders offer the most convenient situation for the operation.

The *sphenoidal sinuses* are two large cells occupying the centre of the body of the sphenoid bone, and divided from each other by a perpendicular septum. They are bounded above by the sella turcica, and by the flat surface of the sphenoid bone in front of that excavation: in front and below, by a thin plate of bone, to the middle of which the septum narium is attached; and behind, by a thick bony substance resulting from the consolidation of the sphenoid and occipital bones. They open into the back of the superior meatus narium by a small and simple round hole on each side, into which the probe is introduced in plate II. fig. 3.

The *frontal sinuses* are irregularly-shaped hollows, formed in the middle and lower portion of the frontal bone. They commence at the root of the nose, and ascend obliquely upwards and outwards, following the course of the superciliary ridge, and causing a perceptible rising of the bone in that part. They are two in number, a right and left, divided by a middle bony septum. A section of the right is seen in plate II. fig. 3, which also shews how it contracts below into a funnel-shaped portion, terminating at the upper and anterior part of the nasal cavity, and brought into view by removing a part of the middle concha.

The *ethmoid cells* are an assemblage of bony hollows, forming the lateral portions of the ethmoid bone, and making up a great part of the bulk of that bone. Their number, figure, and size, are subject to great variety. They occupy the space left between the

os planum, or orbital surface of the ethmoid, and the two superior turbinated bones. In different parts there may be either one or two, or even three cells interposed between these points. Their sides consist of very thin and brittle bony plates, similar indeed to those which make up the whole substance of the ethmoid, except the crista galli. They communicate with each other, and terminate by several distinct openings in the superior and middle meatus of the nose. They are bounded towards the orbit by the os planum behind, and the os lacrymale in front: hence the interval between the two orbits, at their internal surface, is exactly equal to the breadth of the ethmoid bone. On the inside they are covered by the two superior conchæ. The two first figures of the second plate, exhibit a vertical dextro-sinistral section of these cells; which is the best method of shewing their position and size, as well as of illustrating the relations which they bear both to the orbit and nose.

All the cavities, which have now been described, are lined by a mucous membrane, named the *pituitary* or *Schneiderian*. This is tolerably thick in its texture, and of a firm compact substance: which firmness seems to be derived from an intimate union with the periosteum. The nasal surface of the membrane is very smooth, and covered by a mucous fluid secreted by the numerous blood-vessels with which the part abounds. This fluid defends the membrane from the drying effect which the passage of the air over its surface in respiration must otherwise inevitably occasion. The Schneiderian membrane is continuous with the common integuments at the front openings of the nostrils, where there is a gradual change between the two structures. At the posterior apertures it is continued above and at the sides into the lining of the pharynx, and below into the posterior surface of the velum palati.

In order to trace the continuations of this membrane, let us begin at the bottom of the nasal cavity. It ascends along the septum in one uniform expansion. Being reflected to line the under surface of the cribriform plate, it receives the filaments of the olfactory nerve, which perforate the bone at this part. In front, it passes to the nasal surface of the ossa nasi; and behind, to the body of the sphenoid bone, entering the sphenoidal cells, and often contracting considerably the openings, by which these cells communicate with the nose. It is then prolonged over all the parts, which form the external surface of the nasal cavity, entering the ethmoidal, frontal, and maxillary sinuses, where they communicate with the nose, and being continued also into the nasal duct. The membrane is thicker and looser on the unattached convex margins of the conchæ narium, than in other situations, and hence the meatuses of the nose are diminished in size in the recent state. It contracts also very considerably the opening by which the antrum communicates with the middle meatus. It is much thinner in the sinuses than in the proper cavity of the nose, and possesses fewer blood-vessels.

The organ of smelling is placed in the upper part of the nose. The branches of the olfactory nerve descend through the cribriform plate, and, separating into two divisions, are distributed on the pituitary membrane of the upper part of the septum, and on that which covers the two superior turbinated bones.

The nose forms the chief passage for the atmospheric air in its course to and from the lungs: and hence the two apertures of the cavity are, by the nature of their structure, constantly in an open state for the ready passage of the air. The functions of the part considered as the organ of smelling, and as affording a medium for the transmission of the atmosphere, are intimately connected together. The odorous particles of bodies are diffused through the air, and are brought into contact with the olfactory apparatus by the entrance of that air into the nose in inspiration. When we wish to explore more accurately the nature of any odour, we shut the mouth, in order to draw in the whole of the inspired air by the nose, and then make several short inspirations, by which fresh portions of the atmosphere, loaded with the odorous effluvia, are brought into contact with the olfactory membrane: this process is termed *sniffing*. When on the contrary, we desire

to avoid any disagreeable odour, we breathe entirely through the mouth, and draw up the velum palati against the choanæ narium, which entirely cuts off the passage of the air through the nose.

The voice receives a peculiar modification in the windings and hollows of the nasal cavities: this effect is not produced when the velum palati is elevated, nor when the nostrils are closed in front; and the alteration of the sound in either of those cases is absurdly called by the vulgar speaking through the nose.

The act of sneezing is a violent and convulsive action of the expiratory powers, caused by the presence of some irritation in the nose, and producing a forcible expulsion of the air from the lungs. This strong current, by shutting the mouth, is directed through the nose, in order to remove the source of irritation, which is usually of a mechanical nature.

The surgeon should observe the relation that subsists between the pharyngeal opening of the Eustachian tube, and the back aperture of the nose. He will find the tube commencing just opposite the middle meatus of the nose.

The *Larynx* is a hollow organ, placed at the top of the trachea, and composed of several pieces of cartilage, furnished with muscles, by which they are moved on each other. All the air passes through it, both in entering the lungs during inspiration, and in leaving those organs in expiration. It is in the latter case, that the voice is formed; the muscles of the part producing, under the influence of the will, a certain condition of the organ necessary to that effect. By its cartilaginous structure, it is excellently adapted for the transmission of the air; as it remains permanently open.

The larynx occupies the upper and front part of the neck. It is bounded below by the trachea, to which it is inseparably connected, and of which its cavity forms a continuation; above, by the os hyoides, to which it is also closely attached, and by the root of the tongue; in front, by the anterior muscles of the neck; and behind, by the pharynx, which is interposed between it and the bodies of the cervical vertebræ.

Its cavity opens above into the bag of the pharynx, by a wide aperture called the glottis, and placed just behind the root of the tongue. The small moveable cartilage interposed between this opening and the tongue, is named epiglottis. The atmospheric air, brought into the pharynx through the nose and mouth, enters the glottis on its way to the lungs; and the structure of this part, as well as that of the rest of the larynx, is calculated to keep the parts permanently open for its passage. In the third plate, which shews a section of these parts, fig. 63 represents the cut surface of the os hyoides; fig. 76, that of the thyroid cartilage; fig. 78, 80, the cricoid cartilage; and fig. 74, the arytenoid. A particular description of the component parts of the larynx is omitted, as not coming within the object of the work; which regards chiefly the cavity, and its communications.

The internal surface of the larynx, which is every where lined by a continuation of the mucous membrane from the root of the tongue and pharynx, may be divided into two parts, a *superior* and an *inferior*, which communicate together by means of the rima glottidis. The inferior division is made by the cricoid cartilage, and is consequently circular in its form, and incapable of any change in its dimensions. The superior portion is formed in front by the thyroid cartilage and epiglottis, behind by the arytenoid cartilages*; and at the sides by the membranous folds extended between these points. The parts composing this superior division are moveable, and its form and dimensions must consequently be subject to change.

The part by which these two divisions of the laryngeal cavity are connected together, is a slit-like opening, named the *rima-glottidis*, or inferior opening of the glottis; and formed

* The small convex protuberances, which are visible at the posterior part of the glottis, and which are marked in the first plate by fig. 21. 21, are caused by a small bit of cartilage on each side, connected to the arytenoid cartilages, and named by Söemmerring *cornicula laryngis.*

by two membranous folds called *ligamenta-glottidis*, or *thyro-arytenoid ligaments*. These arise from the base of the arytenoid cartilages, and thence pass, in an horizontal direction, forwards and obliquely inwards, to meet together at their insertion, which takes place in the posterior surface of the front projecting part of the thyroid cartilage. The right ligament is seen in this view, and is marked by fig. 77. The form of this opening is that of an isosceles triangle, with the two sides placed horizontally, the base directly backwards, and the vertex forwards.

The thyro-arytenoid ligaments, which form the sides of the opening, are of a nature between membrane and tendinous fibre: they are soft and flexible, but at the surface marked 77, have a manifestly fibrous and shining appearance.

By the passage of the air in expiration through this opening (of which some unknown state, produced in obedience to an exertion of the will, is necessary) the voice is formed.

By changes in the dimensions of the slit, effected by the separation or approximation of the two arytenoid cartilages; assisted also probably by variations in the degree of tension of the ligaments, the alterations in the tone of the voice are effected. Thus the thyro-arytenoid ligaments perform a most important part in the production of the voice, and well deserve the name of *chordæ-vocales*, by which they are often distinguished.

The upper opening of the larynx, by which the superior division of its cavity communicates with the pharynx, seems to have obtained rather improperly the name of glottis, since it is totally unconcerned in the formation of the voice. This opening is placed immediately behind, and rather below the epiglottis. The last named part forms its anterior portion; the two arytenoid cartilages constitute its posterior boundary; and its sides are made up of two folds of membrane extended from the lower part and sides of the epiglottis to the apices of the two arytenoid cartilages. The figure represented by the edges of this opening somewhat resembles a triangle with its base placed forwards and upwards, its apex turned backwards and downwards: so that, in respect to its position, it is exactly the reverse of the inferior triangular opening*.

The internal surface of the larynx is lined by a prolongation of that mucous membrane, which is common to the organs of respiration and digestion. From the back of the tongue it ascends in a rather loose manner over the anterior surface of the epiglottis; and forms three folds connected with different parts of that cartilage. The first proceeds from the middle of the tongue, to the middle and front part of the epiglottis, and is called frenum epiglottidis: the two others are attached to its sides. Passing over the loose edge of the cartilage, it covers the posterior surface, and is continued, at its base, into the larynx. From the sides of the epiglottis it extends to the arytenoid cartilages, so as to form on each side a loose fold, by which the lateral portions of the superior opening of the larynx are constituted. *(Ligamenta thyroidea superiora of Söemmerring? de corp. human. fabr. splanchnolog.* §. 35.*)* The outer layer of this duplicature is continued on each side with the internal membrane of the pharynx; while the internal lamina descends into the larynx. At the posterior limit of the glottis, or at the small space left between the two arytenoid apices, the membrane of the larynx and pharynx are also continuous.

Within the cavity of the larynx, the membrane forms two small cul de sacs, named *ventricles of the larynx*, or *sacculi laryngis*. These result from its descent between the sides of the thyroid cartilage, and the chordæ vocales. They are elongated in their form, and horizontal in their direction, so as to be exactly parallel with the vocal ligaments. The right ventricle is exposed in plate III. fig. 75.

After forming these hollows, the membrane passes over the chordæ vocales into the lower division of the larynx, which it lines; and is then produced from the cricoid cartilage to the trachea.

* The student must be careful not to confound the rima glottidis, or slit-like opening left between the chordæ vocales with the superior aperture of the glottis exhibited in plate I. The distance between them is seen in plate III.

The membrane just described possesses considerable vascularity, and is furnished, in its whole extent, with a copious mucous secretion, produced in some parts, as on the epiglottis, and about the arytenoid cartilages, from obvious and easily demonstrable glands, whose ducts open on the surface. Within the larynx it is endued with the most acute sensibility, as every one will have been able to observe from the accident of a small particle of food coming into contact with it in the act of swallowing. A person would have been inclined to suppose, from considering how all the food passes over the glottis in deglutition, that the accident of its gaining admission into the larynx would be very frequent; but that no large extraneous substance could enter the trachea, from the small dimensions of the rima glottidis. Both of these conclusions would be contrary to the result of experience. The epiglottis protects the aperture of the glottis so completely, that the circumstance of any food entering the larynx may be considered as very uncommon; if we reflect on the vast number of times that an opportunity is afforded for such entrance in every day of the life of every individual. Again, in the recorded instances of foreign bodies entering the trachea, we generally see that their bulk was much greater than we should have expected from considering the dimensions of the rima glottidis. We observe also, that the violent efforts of the expiratory muscles, and the almost suffocating cough excited by them, were inadequate to the expulsion of the foreign body through the lower opening, which had given it admission. Let us suppose any extraneous substance to have fallen into the superior part of the larynx, and to rest on the chordæ vocales, when the chest is in the state of expiration. The person attempts to inspire; the enlargement of the thorax tends to the production of a vacuum, and the foreign body is then forced into the trachea by the pressure of the whole weight of the superincumbent column of the atmosphere. The prodigious force, by which the substance is then driven through the rima glottidis, is far beyond any power which can be brought into action for its expulsion; and there is no chance of removing it, except by the operation of bronchotomy, which affords the only prospect of saving life.

After this description of the mouth, nose, and larynx, we proceed to that of the pharynx, with which those parts communicate.

The *Pharynx* is a large membranous receptacle, placed at the back of the nose, mouth, and larynx, and communicating freely with those organs. Thus it serves as a medium for the passage of the atmospheric air to and from the lungs in the process of respiration; for the reception of the food, which has undergone trituration in the mouth, and for its propulsion towards the stomach. It is adapted to the latter purpose by an external covering of muscular fibres, arranged in strata slightly distinguished from each other, and described by anatomists under the name of constrictores pharyngis muscles. This bag, which is of an elongated form, extends from the basis of the skull above, to the point at which the larynx terminates in the trachea, below. It is bounded at the skull by the basilar process of the occiput, below by the esophagus, which is a cylindrical muscular tube continued from it to the stomach; in front by the cavities of the nose, mouth, and larynx; behind by the cervical vertebræ. Its breadth at the upper part is equal to the space between the pterygoid processes; it is somewhat enlarged towards the middle, opposite to the os hyoides and thyroid cartilage, the cornua of which cause conspicuous risings in the membrane of the pharynx, when the bag is laid open. It diminishes gradually in breadth below, so as to become somewhat funnel-shaped, and its most contracted portion forms the beginning of the esophagus. It cannot be regarded as a complete cavity, since it is deficient on its anterior part. When its back surface is laid open by a perpendicular cut, we see nothing in front but the openings of the nasal and laryngeal cavities, and mouth. The pharynx is therefore an imperfect bag, common in the greatest part of its extent to the air and food, and interposed between the external openings, which give admission to

those, and the respiratory and digestive organs which are the points of their ultimate destination.

The pharynx is firmly attached above, to the basilar process of the occiput, and body of the sphenoid bone, by a strong and dense aponeurotic substance, which is gradually lost on the mucous membrane. It is continued below into the esophagus, opposite the first cartilaginous rings of the trachea; and a sudden contraction at this part, visible externally, indicates the point of continuity between the two organs. The lateral boundaries of the pharynx are the parts which give origin to its constrictor muscles; and these are the pterygoid processes, the cornua of the os hyoides, and the sides of the thyroid and cricoid cartilages.

In taking an internal view of its lateral connexions, we find it attached in a series from above downwards, to the following parts: the posterior openings of the nose, soft palate, back of the mouth, root of the tongue, and larynx. On the front are seen the wide openings of the nose and mouth towards the upper part; but below the bag possesses an anterior portion, which is closely connected to the root of the tongue, and which lies against the back of the larynx. The external surface of the part is connected behind to the bodies of the vertebræ, by a loose cellular substance, and along its sides we notice the course of the carotid arteries and jugular veins.

The sides of the pharynx are composed of muscular fibres externally, and of membrane on the inside. The former arising from the parts already enumerated as the lateral boundaries of the pharynx, are continued over the posterior part of the bag; but their particular description belongs to treatises on the muscles. The lining of the bag is a continuation of that general mucous membrane, which belongs to the digestive and respiratory organs. This is expanded in an uniform manner over the posterior surface of the bag, and by its anterior prolongations on either side becomes continuous with various parts. Above, it is continued at the choanæ narium with the pituitary membrane, and the lining of the Eustachian tube: lower down, it is connected with the pharyngo-palatine arches, and through them with the lining of the mouth; lower still, it passes over the front of the larynx, and covers the projection which the back of that organ makes in the front of the pharynx. At the opening of the glottis it becomes continuous with the membrane that lines the organ of the voice.—At the top of the pharynx, it is extended along the under surface of the body of the sphenoid bone, and thus becomes continuous with the pituitary membrane at the upper margin of the choanæ narium: at the bottom it is prolonged by a circular continuation into the esophagus. The membrane just described is smooth on its surface, and possesses considerable vascularity: it contains many mucous glands, affording a secretion which moistens the part, and facilitates the passage of the food through its cavity.

When we have laid open the pharynx by a longitudinal incision, extending along the whole length of its posterior surface, we obtain the view represented in the first plate of this work. We there see the soft palate hanging down in the middle anterior portion of the cavity, and separating the posterior openings of the nose from that of the mouth. Above the soft palate are two large and somewhat oval apertures (fig. 32.), the posterior openings of the nostrils; separated from each other by the edge of the vomer (fig. 2.). Through these the atmospheric air is constantly passing into and out of the lungs in the alternate processes of inspiration and expiration. Polypous tumours formed in the nose descend by the same passage into the pharynx, and become visible from the throat. Through these openings also the mucous secretion of the nose is drawn into the pharynx, and then expelled by the mouth in the act of spitting. The fourth plate, which exhibits a vertical antero-posterior section of the parts, and is therefore excellently calculated to instruct the student in the natural relations of connexion, position, &c. which they have with each

other, will immediately shew him how easy it is to introduce a hollow bougie through the nose into the esophagus. This is a circumstance of consequence, as affording an extremely simple and ready method of conveying food into the stomach in paralysis of the esophagus, or in the wounds inflicted in attempts at suicide. The posterior extremities of the three turbinated bones (conchæ narium) are visible in the posterior openings of the nose (Plate I.) The superior and smallest cannot in general be discerned in such a view as the present; but it was very plain in the subject which furnished the original painting. The middle one is seen very clearly; but of the inferior the upper surface only is distinguishable. The termination of the middle and superior meatus narium towards the pharynx (fig. 7. 7. 8. 8.) is also exposed: the exact situation and extent of these passages may be understood by a reference to Plate IV. The Eustachian tube, or canal which conveys the external air to the cavity of the tympanum, commences from the throat just opposite to the middle meatus narium. Its broad or trumpet-shaped opening is placed in the point of communication between the nose and pharynx, and is kept permanently open by the cartilaginous nature of its structure. The swelling behind the aperture (Plate IV. fig. 35.) is caused by a piece of the cartilage.

The contracted opening of the mouth into the pharynx (*isthmus faucium*), is placed just under the soft palate. The mode in which this communication is formed has been already described in the present work. The size of this aperture, and the situation of the velum palati, are subject to much variation at different times. The soft palate may be drawn down against the tongue, and its two surfaces will then be anterior and posterior. It may be elevated so as to shut the choanæ narium, and then the surfaces, which before were anterior and posterior, become exactly reversed. In the mid state between the two just mentioned, the velum will be parallel to the horizon, and the posterior surface is then superior, and the anterior is inferior. The choanæ narium are closed by the velum palati during the act of vomiting; when the contents of the stomach are thrown forcibly up the esophagus and pharynx, and would enter the nostrils, if they were not closed by the elevation of the velum. Some of the ejected matter does actually pass in this direction, which we cannot be surprised at, when we consider the violence with which it is driven into the pharynx. The soft palate is also drawn up in the same way, when the process of respiration is carried on through the mouth only. Haller mentions an instance, in which fluids injected from one nostril returned through the other, which can only be explained by the elevation of the soft palate.

The larynx projects into the lower part of the front of the pharynx. In the middle and upper part of this projection there is a large opening, named the glottis, which is the entrance of the larynx. This is situated just at the root of the tongue, so that all the food necessarily passes over it in the act of deglutition; yet the membrane of the larynx is so exquisitely sensible, that it cannot bear the contact of a foreign body. When by accident any extraneous substance touches this delicately organized part, a convulsive cough is excited to expel the cause of irritation. A drop of pure water is sufficient to produce this effect; and if the offending matter be not immediately dislodged, a sense of suffocation, and the most distressing and painful feelings ensue. If we reflect on the fatal consequences that are almost immediately attendant on the interruption of respiration, we shall consider this acute sensibility of the lining of the trachea and larynx as a wise provision against suffocation; by which we receive the alarm on the most distant approach of danger. Since then all the aliment must pass over the glottis, and the entrance of any particle into the cavity must be most carefully guarded against, we have a moveable valve, called the epiglottis, closely connected with the root of the tongue. This is composed of a thin, flexible, and very elastic cartilage. Its thickest part is attached to the root of the tongue, and

is termed the basis. This forms a straight line placed transversely with respect to the axis of the tongue, and measuring rather less than half an inch in breadth. It is then gradually extenuated towards the opposite extremity, which forms an unconnected semicircular thin edge; and it is about half an inch in length between these parts. It is convex on the surface which is placed towards the tongue, and slightly concave on the opposite aspect.

Progress of the food in deglutition. At the time that the elevation and retraction of the tongue urges the morsel of aliment into the pharynx, the velum palati is drawn up against the choanæ narium. Hence when the soft palate is either partially destroyed by ulceration, or so diseased as to have its motions impaired, substances which we swallow, get into the back opening of the nose.

The elevation and dilatation of the pharynx are accompanied by a similar motion of the larynx, which closes the glottis, and therefore prevents the food from entering that cavity. The powers producing that elevation are the stylo-glossi, stylo-hyoidei, stylo-pharyngei, mylo-hyoidei, genio-hyoidei, digastrici, and hyo-thyroidei. Now when the larynx is raised, it is rather inclined forwards, so that the glottis is brought under the epiglottis, which amply covers it. The closing of the mouth, and approximation of the jaws, which take place when we swallow, favour the elevation of the larynx, by affording a fixed point for the action of its muscles. This indeed is not essential, as we can swallow (fluids in particular) with the mouth open; but the act of deglutition is then inconvenient and dangerous.

The elevation and retraction of the tongue, by which the food is thrust into the pharynx, contribute also to the application of the epiglottis over the opening of the larynx. For by such motion of the tongue, the valve is turned backwards and downwards, and thereby meets the ascending larynx. Yet this is not necessary; for we can prove on the dead subject, that the mere elevation of the larynx will close the glottis, while the tongue is not moved at all; and indeed, if we advert to the connexions of the genio-hyoidei and genio-glossi, we must suppose that the tongue often does not contribute to the effect in question. Hence we shall find that deglutition is practicable with the tongue held firmly to the palate. Some physiologists have stated, that the food, by its pressure upon the epiglottis, depresses that organ more completely, and applies it more closely over the opening; and this appears probable enough respecting the more solid masses: but if we consider that a drop of fluid, totally inadequate to produce any effect on the epiglottis, is swallowed just as well as the heavier portions of aliment, we shall not ascribe much influence to this cause.

It is obvious, from the preceding account, that respiration must experience a temporary interruption, while the food is passing over the epiglottis. Hence if a person imprudently laugh, or attempt to speak, while he is swallowing, the escape of air from the lungs, which is necessary in both cases, lifts up the epiglottis, and gives admission to the food, which is then not inaptly stated in common language to go the wrong way. No sooner has the food passed into the pharynx, than the tongue ascends, and the larynx is restored to its former position; the glottis becomes again open for respiration, which had suffered a merely momentary interruption.

From the preceding description it will be immediately understood, that the position of the epiglottis, and the aspect of its surfaces, must differ greatly in the two states of the organ just explained. Its own elasticity, together with the attachment of the frenum, and other strong connexions which tye it to the larynx, cause it to stand up perpendicularly behind the uvula; so that its convex surface is directed forwards, and the concave surface backwards: the thin semicircular edge is turned directly upwards, and the basis downwards.

When the tongue is carried back in the mouth, and the passage of the food depresses it, so that it covers the glottis, the anterior surface becomes superior, and the posterior, inferior. The superior convex edge is then made posterior.

We cannot conclude this part of the subject without making one observation, which will naturally suggest itself to the reflecting mind, on the consideration of the parts whose functions we are now describing. We see that nature has destined the same organ to the performance of two important processes: that the lungs derive their supply of air through the pharynx, and that the same tube conveys our food to the stomach; also, that the course of the aliment is established directly over the opening that admits the air. We know, at the same time, that so close a connexion subsists between life and respiration; that the interruption of this function, even for a very short time, produces inevitable death. Now we can see very clearly, that if the glottis were left open when we swallow, suffocation would be a probable consequence of the first meal, from the entrance of the food into the trachea. Hence the closure of the glottis has not been entrusted to the agency of any of those means, which depend on the exertions of the will, which are always irregular and uncertain, and influenced by numerous circumstances liable to change, from alterations in the bodily or mental state of individuals; but it follows as a necessary and mechanical consequence from certain motions of the organs, and will take place in the dead as well as in the living subject. Further, the very same condition of parts, which produces the danger, brings with it the provision against that danger. The risk obtains only in the act of swallowing; and the elevation of the larynx, which is an essential part of the process of deglutition, closes the glottis, and thereby obviates the risk.

From the connexion subsisting between the larynx and pharynx, as we have already explained, the latter part is elevated together with the former. It is at the same time dilated by the stylo-pharyngei; and, as the larynx is rather carried forwards, a greater space is left between it and the vertebræ for the distension of the pharynx.

The soft palate, which at first was drawn up against the back openings of the nostrils, is again depressed, as soon as the food has passed the isthmus; and its depression assists in promoting the descent of the food into the pharynx. This motion is performed by the palato-glossus, and palato-pharyngeus, which bring the velum palati in contact with the back of the tongue, and thereby cut off the return of the food into the mouth, at the same time that its descent is assisted. This part of the process is performed with difficulty when the tonsils are swelled and inflamed; and the palate is not completely depressed at that time. No sooner has the food entered the pharynx than that bag contracts, and then the space between the tongue and vertebræ is destroyed by the approximation of the posterior part of the pharynx to the tongue. This motion seems to arise from the irritation produced by the presence of the food; for we cannot avoid swallowing whatever has entered the fauces. The action of the superior constrictor muscle draws the upper part of the pharynx against the soft palate, and thereby prevents the food, when pressed by the muscular powers below, from rising towards the nose; while the approximation of the palate itself to the root of the tongue prevents it from ascending again into that cavity. The successive contractions of the middle and lower constrictors now urge the food through the pharynx into the esophagus; the arytenoidei probably closing the rima glottidis while the food passes behind that part. The larynx is now restored to its natural position by the sterno-hyoidei, sterno-thyroidei, and omo-hyoidei; the epiglottis rises by its own elasticity; and the levator palati, and azygus uvulæ would bring back the palate and uvula to their usual condition.

We see, therefore, that the business of deglutition requires the concurrence of numerous parts, and the co-operation of several motions, and becomes consequently a complicated and difficult study. We can understand how easily the process may be deranged and impaired

by the effects of accident or disease; as by wounds or disease of the tongue, by ulcers of the palate or tonsils, or fissures either in the bony or soft palates, by destruction of the epiglottis, or by disease affecting its motions, &c. We observe, also, that although the passage from the mouth to the stomach is placed perpendicularly, the aliment by no means descends from its own weight, but is urged through the whole course by muscular contraction. Hence we may swallow with the trunk inverted; and in several animals the food passes upwards to the stomach. Hence deglutition is destroyed altogether by paralytic affections of the muscles concerned in it. The swallowing of fluids can no more be effected by their own weight than that of solids: the contact of the sides of the pharynx and esophagus presents an obstacle which a mouthful of fluid is not capable of overcoming, and which requires a contraction of the muscles. Between the opposing sides of the tube, and the contracting fibres of the organ, fluids are collected into a globular form, like the more solid species of food; as we may observe in a horse when drinking, where the passage of the fluid in the manner just described is very obvious.

WILLIAM LAWRENCE.

THE END.

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